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TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN YEAR 1932.

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CERTIFICATES-OF-RECORD were issued to 486 cows in 1932, and of this total 443 cows qualified in the Yearly Test Division and the remaining 43 in the 305-day Division. Evidence would appear to indicate that the ten-months class is meeting with scant favour, and entries to date have scarcely justified its inception. At time of writing there are only thirteen breeders testing in this class, the entries numbering twenty-two cows, proving a still further rapid fall from the first year's total of approximately 110 cows.

During 1932 a new classification, to be known as "III Class C.O.R.," was introduced. Roughly speaking, this class is for those cows which qualify for first- or second-class C.O.R. in all respects save subsequent calving. The issue of certificates under the new class is not intended to be retrospective, although the Dairy Division is prepared to issue third-class certificates on past performances, where eligible, to any owner who is prepared to make the usual C.O.R. declaration as to milk weights and general particulars. The new class is operative from the commencement of the current year. The intention is merely to provide for placing performances on permanent record, and records in this class will not be recognized by the various purebred cattle-breeders' associations from the point of view of subsidies, medals, and awards, and the general publicity which first-class certificates now enjoy. Care will be taken to give no inducement to the making of high records at the expense of keeping the cow non-pregnant.

The outstanding feature of the past year's work was the performance of Mr. P. J. Petersen's Jersey cow Woodlands Felicie, whose production of 1,220·89 lb. butterfat from 17,332·6 lb. milk is a world's record for the breed. The performance of Woodlands Felicie was dealt with in detail in the *Journal* for September and November, 1932. Another very fine record completed during the year was that of the Piri Land Company's Friesian cow Totara C.R. Buttercup, particulars of whose yield of over 1,000 lb. butterfat will be given later in this review.

(1) C.O.R. YEARLY TEST DIVISION.

As previously stated, 443 certificates were issued in this division during the calendar year 1932. These certificates represented an average production of 500·35 lb. butterfat, an advance of 5·18 lb. over the 1931 average of 495·17 lb., which was for 630 certificates.

First-class Certificates issued.

From the commencement of the C.O.R. system in 1912 to the end of the calendar year 1932 first-class certificates have been issued to 8,131 cows. This, it will be noted, is the work of twenty years. Divided into breeds, there were 5,809 Jersey cows, 1,625 Friesians, 424 Milking Shorthorns, 211 Ayrshires, 62 Red Polls, and 1 Guernsey. Particulars of yearly certificates issued during the past two years are given in the following table :—

Table 1.

Breed.	1932.			1931.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	317	30	347	459	44	503
Friesian	56	15	71	74	21	95
Milking Shorthorn..	16	..	16	17	1	18
Ayrshire	6	..	6	11	..	11
Red Poll	3	..	3	2	1	3
Totals ..	398	45	443	563	67	630

Second-class Certificates.

Twenty-four second-class certificates were issued during the year, a decrease of eleven from the 1931 total of thirty-five. There were twenty-two Jerseys and two Friesians, the former averaging 479·34 lb. butterfat and the latter 742·78 lb.

Period between Calvings.

The C.O.R. rules covering the yearly test require calving within 455 days for first-class C.O.R., and within 485 days for second class. The average period between calving for commencement of test and calving subsequent to test for the 443 cows qualifying for first-class certificate in 1932 was 396 days, or one day less than for the 630 cows of 1931. The 24 second-class C.O.R. cows averaged 469 days as compared with 461 days for 35 cows for the preceding year. The position so far as the first-class cows are concerned must be considered very satisfactory, as in the average case there was only one month between expiry of test on the 365th day and the date of calving.

Jerseys.

Class Leaders.

There was only one change in the Jersey class-leadership list during the year, Woodlands Felicie having displaced Keston Flower in the four-year-olds. Class leaders for the breed are now as follows :—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Coniston Goldie ..	R. Waterhouse, Papakura	2 40	244·5	365	10,759·4	742·71
Senior Two-year-old.						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old.						
Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old.						
Woodlands Felicie ..	P. J. Petersen, Waitara	4 364	384·9	365	17,332·6	1,220·89
Mature.						
Holly Oak's Annie..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

FIG. 1. WOODLANDS FELICIE (P. J. PETERSEN, WAITARA).

New leader of the Jersey four-year-old class: 17,332·6 lb. milk, 1,220·89 lb. butterfat. World butterfat champion for the breed.

JERSEY CLASS AVERAGES.

Certificates were issued to 347 Jerseys in the Yearly Division in 1932, their average production of 488·31 lb. butterfat showing an increase of 2·06 lb. as compared with an average of 486·25 lb. for the

503 cows of this breed qualifying in 1931. The class averages for 1932 and 1931 are given in the following table :—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1932.		lb.	lb.
Junior two-year-old ..	143	356	7,520·8	430·30
Senior two-year-old ..	33	346	7,916·9	442·51
Three-year-old	56	352	8,995·9	511·96
Four-year-old	41	358	10,188·6	573·61
Mature	74	354	9,880·4	555·68
	1931.			
Junior two-year-old ..	191	353	7,513·6	427·23
Senior two-year-old ..	62	347	8,070·5	460·11
Three-year-old	66	348	9,046·7	509·36
Four-year-old	49	354	9,657·3	549·56
Mature	135	350	9,914·7	547·49

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in Table 4 :—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	2,609	346	7,077·1	396·87
Senior two-year-old ..	696	345	7,770·9	438·68
Three-year-old	977	343	8,501·8	475·02
Four-year-old	667	346	9,055·5	503·76
Mature	1,616	346	9,432·1	518·35
All	6,565	346	8,143·4	453·70
Average test, 5·57.				

Jersey C.O.R. Bulls.

No less than 2,097 different sires are represented by the 5,809 Jersey cows which have received certificates to date. C.O.R. sires—that is to say, those which have four or more daughters with first-class certificate, each daughter being from a different dam—number 403. Champion butterfat bulls now total seventeen. This class is one inaugurated by the New Zealand Jersey Cattle Breeders' Association, the qualifications being as follows: Each bull must have five or more daughters (each from a different dam) which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years old, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. (The corresponding standards for cows in the 305-day

test have recently been changed by the Association and are now 460, 510, 560, and 620 lb. butterfat respectively. For 1931, the first year of operation of the 305-day test, they were 25 lb. less in each case than for the full year test.)

Friesians.

Class Leaders.

So far as C.O.R. testing in 1932 for the Friesian breed is concerned, interest focuses on the Piri Land Company's cow Totara C.R. Buttercup, New Zealand's ninth C.O.R. cow to pass the 1,000 lb. butterfat mark, and now the holder of two class-leaderships for her breed. This cow has been under C.O.R. test for three consecutive seasons. Her first test was commenced at her first calving, when she was 2 years 205 days old, and her credit for that season was 790·66 lb. butterfat from 21,208·6 lb. milk in 365 days. She calved subsequent to test at 407 days and commenced her second period at the age of 3 years 247 days, her final credit for the 365 days being 989·10 lb. butterfat from 25,885·3 lb. milk. This yield placed her at the head of the senior three-year-old Friesians. Calving on this occasion was 385 days subsequent to date of calving for commencement of test. Totara C.R. Buttercup's third consecutive test was commenced on the 29th October, 1931, when she was 4 years 267 days old. This test was concluded with the excellent record of 1,079·14 lb. butterfat from 27,108·1 lb. milk in 365 days, a production which takes her to the head of the senior four-year-old Friesians. She calved subsequent to test on the 8th December, 1932, making 406 days between calvings. Totara C.R. Buttercup has therefore produced a total of 2,858·90 lb. butterfat in three consecutive lactations, or an average of 952·96 lb. Moreover, she has averaged over 1,000 lb. on her last two lactations. There is outstanding evidence here of production, constitution, and consistency, and Totara C.R. Buttercup has made a fair beginning toward winning a place among the life-time champions of the dairy world.

In Table 5 are given particulars of the records of the nine New Zealand cows which, up to the close of the calendar year 1932, have gained first-class certificates-of-record on production of 1,000 lb. butterfat or over.

Table 5.

Name of Cow.	Breed.	Yield.			Age at Start of Test.	
		Days.	Milk.	Butterfat.		
			lb.	lb.	Yrs.	days.
Woodlands Felicie ..	Jersey ..	365	17,332·6	1,220·89	4	364
Alcartra Clothilde Pietje	Friesian ..	365	31,312·5	1,145·24	7	357
Totara C.R. Buttercup	Friesian ..	365	27,108·1	1,079·14	4	267
Holly Oak's Annie ..	Jersey ..	365	18,522·7	1,056·49	5	9
Hilda Minto de Kol ..	Friesian ..	365	27,773·8	1,046·31	12	56
Vivandiere	Jersey ..	365	17,282·1	1,036·09	6	10
Totara Sylvia Colantha	Friesian ..	365	26,310·1	1,024·37	5	229
Pretty's Flirt ..	Jersey ..	365	16,684·1	1,010·49	6	353
Monavale Queen Bess ..	Friesian ..	365	26,461·8	1,002·20	7	363

The Friesian class leaders are now as follows :—

Table 6.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old. Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old Totara C. R. Buttercup	Piri Land Co., Auckland	3 247	336·7	365	25 885·3	989 10
Junior Four-year-old. Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old. Totara C.R. Buttercup	Piri Land Co., Auckland	4 267	375·2	365	27,108·1	1,079·14
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

FIG. 2. TOTARA C. R. BUTTERCUP (PIRI LAND CO., AUCKLAND).

New leader of the Friesian senior four-year-old class: 27,108·1 lb. milk, 1,079·14 lb. butterfat.

Friesian Class Averages.

Seventy-one Friesian cows gained certificates in the yearly division in 1932, a decrease of twenty-four cows from 1931. Average production for the breed reached the very creditable figure of 583·61 lb. butterfat, as compared with 559·01 lb. for 1931. The Friesian class averages for 1932 and 1931 are as follows :—

Table 7.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1932.		lb.	lb.
Junior two-year-old ..	30	360	13,390·8	495·31
Senior two-year-old ..	4	365	15,928·8	592·83
Junior three-year-old ..	3	364	11,932·1	463·79
Senior three-year-old ..	4	365	18,365·2	718·24
Junior four-year-old ..	7	362	17,287·2	611·12
Senior four-year-old ..	4	365	22,419·6	812·16
Mature	19	360	17,901·8	653·43
	1931.			
Junior two-year-old ..	33	346	13,997·1	500·25
Senior two-year-old ..	6	347	14,025·4	500·51
Junior three-year-old ..	7	349	15,069·2	528·10
Senior three-year-old ..	11	337	14,441·5	529·48
Junior four-year-old ..	8	345	16,719·5	608·30
Senior four-year-old ..	6	360	16,629·6	599·53
Mature	24	352	18,115·6	650·40

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system are given in the following table :—

Table 8.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	599	345	11,777·1	418·46
Senior two-year-old ..	251	347	12,638·4	449·08
Junior three-year-old ..	182	342	13,342·1	469·06
Senior three-year-old ..	183	336	13,941·5	500·30
Junior four-year-old ..	123	345	15,098·5	533·48
Senior four-year-old ..	124	347	16,077·6	561·54
Mature	543	342	15,939·7	559·82
All	2,005	343	13,821·6	488·55
Average Test, 3·53.				

Friesian C.O.R. Bulls.

One hundred and ten Friesian bulls have now qualified for the C.O.R. class, three new names having been added during the year under review. Some 575 sires are represented in the 1,625 Friesian cows certificated to the end of the calendar year 1932.

Milking Shorthorns.

Class Leaders.

No changes in the Milking Shorthorn class leaders took place during the year. For the information of readers the list is repeated as follows :—

Table 9.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
		Yrs.dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Matangi Ruth 2nd..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

Sixteen milking shorthorn cows gained certificates in 1932, their average production being 441·22 lb. butterfat.

The averages, class by class, of all certificates issued to milking shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table :—

Table 10.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	54	348	8,360·9	343·32
Senior two-year-old ..	37	348	8,858·9	360·76
Junior three-year-old ..	25	336	9,751·7	392·95
Senior three-year-old ..	28	342	10,704·7	446·32
Junior four-year-old ..	23	348	11,056·7	444·29
Senior four-year-old* ..	30	342	11,440·3	452·00
Mature	268	341	11,760·0	470·87
All	465	342	10,907·5	439·10
Average test, 4·02.				

* No additions in 1932.

Milking Shorthorn C.O.R. Bulls.

C.O.R. bulls of this breed now number fourteen, two new names having been added during the year. The 424 cows certificated to the end of 1932 were sired by 135 different bulls.

Ayrshires.

Six Ayrshire cows qualified for first-class certificates in 1932, their average yield working out at 431·67 lb. butterfat. The class leaders were unchanged, the list remaining as follows :—

Table 11.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Green-bank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria ..	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	646·98
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are supplied by the following table :—

Table 12.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	63	345	8,890·0	369·08
Three-year-old*	38	347	10,043·0	414·16
Four-year-old	27	346	11,378·0	459·52
Mature	109	348	11,905·5	484·54
All	237	347	10,745·2	439·71
Average test, 4·09.				

* No additions in 1932.

Ayrshire C.O.R. Bulls.

Ayrshire C.O.R. bulls now number eleven, two further bulls having qualified during the year. Some 120 sires are represented in the 211 Ayrshire cows certificated to the end of 1932.

Red Polls.

Certificates were issued to three Red Poll cows in 1932, two being in the two-year-old class and one in the mature class. Their average production was 374·51 lb. butterfat. The class leaders for the breed remained as at the close of the previous year, and particulars are repeated as follows :—

Table 13.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Waihou Pip	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

Red Poll Class Averages.

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows :—

Table 14.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	39	345	7,616·4	338·15
Three-year-old*	14	348	8,004·4	350·45
Four-year-old*	6	343	9,909·1	425·86
Mature	23	338	10,496·3	440·68
All	82	343	8,658·2	375·42
Average test, 4·33.				

* No additions in 1932.

Red Poll C.O.R. Bulls.

Four Red Poll bulls have now qualified for the C.O.R. class, while the sixty-two Red Poll cows certificated to date represent twenty-five sires.

(2) C.O.R. 305-DAY TEST DIVISION.

Of the forty-three first-class 305-day certificates issued in 1932, forty-one went to Jerseys and two to Friesians. One second-class certificate was also issued, this being gained by a Jersey cow which failed by some twenty days to calve within the 395 days provided for in the rules governing the system.

Jerseys.

Class Leaders.

Three changes in the Jersey class leaderships of this Division occurred during the year. In the junior two-year-olds Mr. R. S. Tuck's Beloved, with 500·36 lb. butterfat, is replaced by Mr. F. Geck's Leafield Goldbird, 523·25 lb. In the three-year-olds Mr. C. A. Willis's Brentwood Emerald, 608·13 lb., gives way to Mr. J. Inglis's Ku Ku Solid Gold, 626·48 lb. The third change falls in the mature class, where Mr. J. A. Mitchell's Perfection's Hopeful, 664·51 lb., displaces Mr. H. C. Sampson's Woodlands Veta, 578·34 lb. butterfat. The class leaders are therefore now as follows :—

Table 15.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Leafield Goldbird ..	F. Geck, Te Kauwhata	2 8	251·3	305	9,894·6	523·25
Senior Two-year-old.						
Erinview Choice ..	J. Murray, Woodville	2 344	284·9	305	9,798·7	559·42
Three-year-old.						
Ku Ku Solid Gold ..	J. Inglis, Riwaka ..	3 302	317·2	305	11,990·6	626·48
Four-year-old.						
Brentwood Lady Winnie	C. A. Willis, Pukekohe	4 11	324·6	305	10,297·3	535·47
Mature.						
Perfection's Hopeful	J. A. Mitchell, Longburn	5 339	360·0	305	11,090·7	664·51

Jersey Class Averages.

The production averages, according to age class, of the forty-one certificates issued to cows of the Jersey breed during the year under review, are given in Table 16. The average for all the cows was 426·78 lb. butterfat, and the average test 5·56 per cent.

Table 16.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1932.		lb.	lb.
Junior two-year-old ..	17	304	6,543·1	372·43
Senior two-year-old ..	4	299	7,605·5	443·31
Three-year-old	9	298	8,385·6	455·18
Four-year-old	1	305	7,672·1	421·92
Mature	10	298	8,950·1	487·48

Friesians.

Of the two Friesian certificates issued in the 305-day Division in 1932 one went to Mr. W. J. Eames's Livingstone Canary Alcartra, a junior two-year-old, which produced 338·93 lb. butterfat, and the other to the mature cow Mahoe Asperella, owned by Major R. A. Wilson, Bulls. This cow's record of 533·87 lb. butterfat entitles her to leadership of the mature class. The class leaders are now as follows :—

Table 17.

Name of Cows and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Waterloo Queen Helen Beets	R. S. Tuck, jun., Waharoa	2 4	250·9	305	11,585·5	425·48
Senior Two-year-old.						
Rosevale Beauty Posch Griselda	E. H. Watson, Windsor	2 216	272·1	305	12,273·5	468·50
Junior Three-year-old	..	..	..	..	..	..
Senior Three-year-old.						
Sealands Alcartra Fobes	H. G. A. Cameron, Weraroa	3 304	317·4	305	10,407·8	389·04
Junior Four-year-old	..	..	..	..	..	..
Senior Four-year-old.						
Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4 357	359·2	305	15,311·9	557·71
Mature.						
Mahoe Asperella ..	R. A. Wilson, Bulls ..	9 6	360·0	305	12,674·6	533·87

We desire to again express thanks for the courtesy and co-operation of the secretaries of the various breeders' associations whose breeds are represented in C.O.R. testing.

Quality of the New Season's Wheat Crop.—The following advice was received from the Wheat Research Institute, Christchurch, on 24th February: "The Institute has to date received for testing 256 samples of wheat from the new season's crop, and has milled and baked them. The average baking score is about six points above that of the samples received to this date last year, so that the season's crop is equal in quality to that of 1931. This recovery to normal quality will be most welcome to millers and bakers, and shows that the difficult nature of last season's wheat was purely the result of the abnormal drought to which the wheat was subjected during its ripening period."

WHEAT DISEASES IN NEW ZEALAND.

NOTES ON THEIR INCIDENCE AND CONTROL.

J. C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

THE chief diseases which attack wheat in New Zealand, in the order of their relative importance, are the rusts, the smuts, mildew, take-all, and wheat-scab.

THE RUSTS.

Two species of rust fungi attack wheat in this country—leaf-rust and stem-rust. Leaf-rust appears first, usually about the heading stage, but sometimes when the plants are only a few inches high. The fungus only attacks the leaf and leaf-sheaths, and, depending on the severity of the infection, it destroys to a greater or lesser extent the assimilative surface of the leaf, thus reducing the plant's vigour and, consequently, yield. The incidence of the rust appears to depend mostly on the climate, a warm moist spring such as the last being particularly favourable to its onset. There appears to be some difference in susceptibility among the wheat varieties, but none of those commonly grown in New Zealand is entirely resistant.

Stem-rust attacks all parts of the wheat plant, but is most noticeable on the stem and head. In a normal season and with early-sown crops it only appears as the heads are ripening off, and then seems to cause little damage, but in a favourable rust season such as that of 1932–33, and especially in late spring-sown crops, it may attack the plants shortly after heading, leading to severe and even total loss. There is evidence that some varieties of wheat are more susceptible to attack by this rust than are others, but this measure of susceptibility also appears to vary with the locality. For instance, Solid Straw Tuscan, which in general is only moderately susceptible in Canterbury, is almost invariably heavily rusted when grown in the North Island.

Little is known as to the sources of the early infection of wheat by the rusts, but, once established, they produce innumerable spores which in turn rapidly infect neighbouring plants. It is for this reason that late-sown or slow-maturing crops are more liable to heavy infection. None of the usual seed treatments appears to have any effect on the rusts. They can be kept in check by dusting the plants at frequent intervals with sulphur, but this method, while useful in small experimental plots, has not yet been adapted to ordinary field crops.

THE SMUTS.

Two smuts are commonly present on New Zealand wheat—loose-smut and stinking-smut. Both are seed-borne diseases and can be controlled by appropriate seed treatment. Loose-smut can be eliminated only by a hot-water treatment of the seed, a method which, though too difficult and risky for the average farmer, has been used to clean up nucleus lines of most varieties. The product of this seed has been bulked up and can be bought under Government certificate in regard to purity and freedom from the disease.

There is a great difference in the susceptibility of the common New Zealand varieties to loose-smut. College Hunter's appears to be

A TWO HEALTHY HEADS OF WHEAT WITH NORMAL GRAIN; *B* TWO RUSTED HEADS WITH SHRIVELLED GRAIN; *C* TWO SCABBED HEADS (THESE CONTAINED NO GRAIN); *D* TWO HEADS OF STINKING-SMUT WITH SMUT-BALLS; *E* TWO HEADS OF LOOSE-SMUT.

All specimens collected from a single plot of Solid Straw Tuscan wheat at harvest.

[*Photo by H. Drake.*

immune, Solid Straw Tuscan rarely shows more than a trace, though before the introduction of the certification system the amount present in the average crop showed a tendency to increase. White and Purple Straw Tuscans are very susceptible, as are also the favourite North Island wheats Major and Jumbuck. The loss caused by loose-smut is confined to the actual smutted heads, since the spores are all blown away before harvest and therefore do not affect the rest of the grain.

Stinking-smut is much the most dangerous disease of wheat—in fact, it is only because of its successful control by means of seed treatment that modern wheat-growing is even possible. The smut-balls produced by this disease remain intact till harvest, but during the subsequent threshing and cleaning become broken, and the contained spores become distributed through the whole bulk of the wheat. Seed wheat, even when harvested from a clean crop, is very likely to become

contaminated by spores remaining in threshing mills and cleaning machinery from previous crops. The presence of a very small amount of this smut greatly reduces the market value of the sample.

Pickling the seed with either bluestone or formalin will control stinking-smut quite satisfactorily, but both methods have serious disadvantages. Bluestone always lowers the vitality of the seed, while formalin may have a disastrous effect on germination if the pickling is not properly carried out.

Dusting the seed with copper carbonate has proved to be efficacious in controlling the smut without any risk of damage to the seed. There are some other materials manufactured for the dusting of wheat which show certain advantages over copper carbonate; these are the organic mercury compounds sold under the trade names of Ceresan, Semesan, and Agrosan G. As seed disinfectants for stinking-smut they are more thorough in their effect than copper carbonate, which frequently fails to give complete disinfection. This is especially true when using 2 oz. or less per bushel of a cheap copper carbonate of low copper content. But their outstanding advantage is the fact that, for some as yet unexplained reason, they exhibit at times a distinct apparent stimulatory effect on the seedlings and never a depressing effect.

The following results of an experiment during the 1932–33 season, designed primarily to compare the fungicidal action of sulphur as against copper carbonate and Ceresan, are very typical of the results obtained in other seasons, though in this case there was no noticeable difference in plant vigour or yield between any of the treatments. One thousand seeds were taken for each treatment from a single sample of naturally smut-infected Solid Straw Tuscan wheat. They were sown in September by hand 2 in. apart in rod rows at the Plant Research Station, Palmerston North, and the plants pulled, examined, and recorded early in February.

Table of Results.

Treatment.	Plants per Hundred Seeds sown.	Number infected.	
		Stinking-smut.	Loose-smut.
Control (no treatment)	85	54·0	0·4
Hot water, 6 hours at 55° F., plus 10 minutes at 127° F.	66	0·0	0·0
Copper carbonate (18 per cent. copper), 2 oz. to bushel	84	0·2	0·4
Copper carbonate (18 per cent. copper), 4 oz. to bushel	85	0·0	0·6
Ceresan, 2 oz. to bushel	83	0·0	0·5
"Atomic" sulphur, 4 oz. to bushel ..	83	19·0	0·4

It will be seen from these results that both smuts were eliminated only by the hot-water treatment, but at some expense to the germination. The sulphur dust reduced the amount of stinking-smut, but not sufficiently to be of practical value. The copper carbonate at 2 oz. per bushel gave almost complete control, while the Ceresan at 2 oz. and copper carbonate at 4 oz. per bushel gave complete control of stinking-smut with no significant reduction in germination.

Mildew.

The incidence of mildew on wheat appears to be governed in the main by climatic conditions during the spring growth. It appears to develop best in shade, so that thick stands, especially under trees or on shady faces, are particularly liable to attack. There appears to be some difference in susceptibility among the wheat varieties, but so many factors are involved that the differences, and even the total loss caused by the disease, are very difficult to estimate. Seed treatments appear not to affect the amount of mildew which appears on the subsequent plants.

Take-all.

This disease causes very severe losses in certain localities where it has become well established in the soil. There is some evidence that infection can be carried to clean land by infected seed, and that once established it can persist for several seasons in the soil. The stubble of infected crops should be burnt, and neither wheat nor barley should be grown on the land for at least two seasons. Oats, peas, brassicas, or potatoes may safely be used, the latter being especially suitable, since the necessary cultivation of this crop tends to eliminate weed carriers of the disease.

Wheat-scab.

This is a condition rather than a disease, since it appears only on wheat that has been weakened by some other cause. Unthrifty plants growing on poor or badly cultivated land, on overwet or overdry land, on take-all or twitch patches, or which through late sowing or unfavourable weather have been severely attacked by rust and mildew, usually show the pink and dark discolorations characteristic of scab. The fungus is also largely responsible for the discoloration of wheat left over long in stook. It does not affect normal healthy plants beyond causing a certain amount of discoloration of the outer glumes in some varieties.

Advice on practical Control of Wheat Diseases.

(1) Choose a variety of wheat which has proved suitable for the locality. This in general means a wheat that does not rust badly in that locality.

(2) Use Government certified seed or, failing that, seed from a crop known to be free from take-all and loose-smut.

(3) Dust the seed with copper carbonate, or with Ceresan, Semesan, or Agrosan G, before sowing, to prevent stinking-smut. Most large seed-cleaning plants have now installed dusting machines, so that seed wheat can be procured from them ready dusted, but a simple inexpensive dusting apparatus can readily be made on most farms and the seed dusted at any time before sowing.

(4) Prepare the seed-bed thoroughly, manure liberally, and avoid heavy seeding. Strongly growing, sturdy, well-spaced plants are more resistant to mildew and scab.

(5) Do not sow late in the spring in the vicinity of earlier-sown wheat. Such a crop is almost sure to be severely rusted.

HAIRY FIBRES OF THE ROMNEY SHEEP.

II. SICKLE-FIBRES.

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THIS article is the second of a series on the fibre types of the Romney sheep considered especially with reference to hairiness. The first article (*Journal*, January, 1933) gave an account of the halo-hairs which stand out so prominently in the birthcoat. It was then explained (p. 13 and Fig. 3) that a series of intermediates exist leading by degrees from halo-hairs to sickle-fibres having a hairy post-natal region. This transition is now further illustrated in Fig. 1, which shows tufts from new-born lambs. When a name for these intermediates is needed the term "super-sickle" is used. A strict distinction between these and sickle-fibres proper is made, when this is necessary, on the "neck," the comparatively fine region below the sickle-end that is grown mainly, if not entirely, before birth. For at least part of its length the neck

FIG. 1. TUFTS FROM THE COAT OF NEW-BORN LAMBS. (× 1½.)

a, Tuft with many large halo-hairs; *b*, tuft with plentiful small halo-hairs and many super-sickle-fibres; *c*, tuft with many super-sickle-fibres; *d*, tuft with many sickle-fibres, but no large super-sickle-fibres or halo-hairs.

[*Photo by H. Drake.*

of a super-sickle contains medulla coarse enough to give a chalky appearance noticeable without magnification. The neck of a sickle-fibre is frequently quite free from even fine medulla.

USE OF COVERS IN STUDIES OF FIBRE TYPES.

In the present studies it is often necessary to observe the characters of particular fibre types in parts grown long after birth. As the types can be distinguished only if the tips are intact it is necessary to protect them by covers, because the points of the staples are badly weathered by the time the lamb is four months old. Besides preserving the tips the covers retain fibres that come loose, and much of what is known about the successors of shed fibres has been found out through covering.

Covers have been used made of a light waterproof material, 8 oz. brown proofed duck. The region specially studied has been the middle line of the back at the level of the last rib. The cover for this part is easily fastened in position by three elastic bands under the belly. To reduce the risk of accident this saddle cover has itself sometimes been protected by a larger loose cover fastened by bands, generally of thick string, round the neck and hind legs, with a single slack band under the belly. Sometimes small covers have been sewn on the coat on various extremities. In order to cover most of the trunk in studies of many different parts of the coat Miss N. Galpin has used garments constructed to take the limbs that tie with tape round the legs and neck and have an overlapping flap on the back which is fastened with safety pins. As far as it has been possible to tell, the use of covers has no effect upon any feature of wool growth that has been studied, though, by preventing the washing-out of yolk, covering does of course keep the fleece in very pleasing condition.

FIG. 2. LAMB WITH COAT PROTECTED BY SADDLE COVER AND BY SMALL COVERS ON THE BRITCH, POLL, AND BRISKET.

[Photo by M. T. Gabriel.

The covers have generally been put on at the age of from four to seven weeks. The object in covering at this stage is to prevent the loss of the shed halo-hairs and sickle-fibres. If covers are put on in the very early days they need careful watching, for the lamb is then growing at a great rate and the short wool does not afford much protection to the skin against an elastic band that becomes tight. Covering as early as convenient is best for the preservation of the apical ends of halo-hairs, which are easily damaged on the back where there is so much friction against the body of the mother. The sickle-ends are also rather readily broken off, but apart from those of the halos most of the tips remain intact until after the start of the shedding of birthcoat kemp that is such a feature of the third month, but the fourth month brings rapid disintegration of the tips. The covers have continued to fulfil their function until shearing-time, when the animal is a little more than twelve months old.

Characters of Sickle-fibres and their Variation.

Sickle-fibres were discovered by Professor J. E. Duerden in the South African Merino,* and he has also found them in a large number of other breeds of sheep.†

By no means all sickle-fibres become hairy after birth. Indeed, one might well regard the roots of sickle-fibres as displaying great resource and ingenuity in discovering varied lines of action. Sickle-fibres of many different kinds may be present in one small tuft, and there is great variation in the collection of sickle-fibres found on different parts of

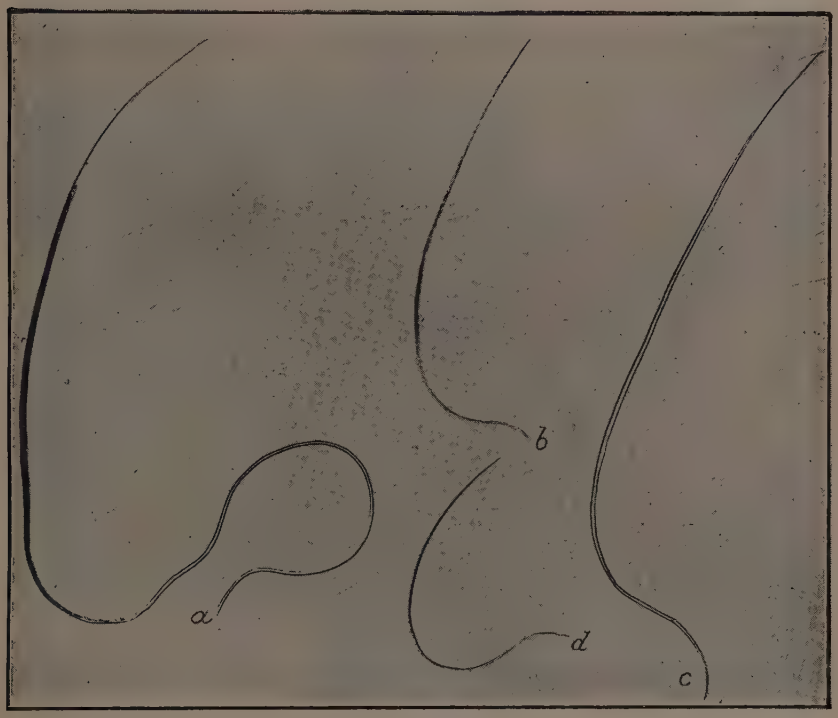

FIG. 3. SICKLE-ENDS. (× 17.)

a, Fairly large with much medulla; *b*, small with a little medulla; *c*, slim and fairly long with no medulla; *d*, small with no medulla.

[*Photo by M. T. Gabriel.*

the body or on the same region of different lambs. With rare exceptions, to be dealt with in due course, sickle-fibres of some kind always occur on the region of the back that has been specially studied.

The shape of the sickle-ends is shown in the various illustrations. The ends may be longer or shorter, coarser or finer, and with or without medulla. Usually their curve is very like that of the implement after which they are named. Some part of the sickle-end is perceptibly coarser than the part of the neck which immediately follows. If the end is at all stout the shapely thinning of the basal portion is a

* *Journal of the Textile Institute*, 18, 1927. † *Nature*, 130, 736, Nov. 12, 1932.

characteristic feature. Occasionally the form of a sickle-end is not as definite as usual, but there is rarely any difficulty in distinguishing a sickle-fibre at a glance.

Fibres beginning to grow after birth have never been found to possess a sickle-end. Indeed, the examination of unborn lambs by Miss A. Hefford and Miss Galpin has shown that sickle-fibres begin their development very early, probably sooner than any other fibres except the coarser birthcoat kemps already described. The thinning in the neck region is regarded as one expression of a restricting or checking force. This "pre-natal check" is manifold in its effects upon the development of the coat, and the recognition of this phenomenon has given the key to the classification of the fibre type arrays of different specimens of lamb's wool. Certain other features of sickle-fibres now to be described are explained in terms of the pre-natal check, and the idea is to be developed further in a subsequent contribution.

In the classification of fibre types the various kinds of sickle-fibres alone make a lengthy list, for they differ in several distinct features of structure or developmental history. Attention may be drawn to the following variations:—

(1) The sickle-ends vary in size and in degree of medullation.

(2) Growth may cease after a definite time or may be indeterminate.

(3) When cessation of growth occurs this may be at very different stages of development.

(4) There are great differences in the diameter and medullation of the early post-natal region.

(5) Coarsely medullated sickle-fibres that do not cease growing at about the age of two months differ in the manner of passing through this critical time in their life history.

VARIATIONS IN SIZE AND MEDULLATION OF THE SICKLE-ENDS.

On this point little will be said in the present account. Fibres with sickle-ends of any size, large to small, may show any one of the other alternative characterizations. On a later occasion when consideration is given to the several sorts of collections of fibres, or fibre-type arrays, the significance attaching to the size of the sickle-end will be discussed.

SICKLE-FIBRES CEASING TO GROW BEFORE OR ABOUT THE TIME OF BIRTH.

It will be recalled from the previous article (p. 13 and Fig. 4) that some small but well-medullated kemps have ceased to grow at the time of birth, and one shed fibre was figured (Fig. 4, *h*) with a large sickle-end and some little medulla in parts of the remainder of the fibre, which was thus like the neck of a super-sickle fibre. It is a more common thing for sickle-fibres to complete their growth about the time of birth, and some, judging by the extreme shortness of the fine region below the sickle-end, must stop growing well before the lamb is born. They are curiously minute objects to encounter in a study of hairiness that started upon long coarse fibres in adult sheep. Many of these little fibres are well medullated in the sickle-end. Fibres of this kind that do not grow after birth are called "baby sickle-fibres" (Fig. 4). They are often found loose in wool specimens taken immediately after birth.

Any doubt as to their having been shed, instead of broken off, is dispelled by the fact that some of them have the basal end surrounded by a little sheath, as is often the way with halo-hairs and other birthcoat kemps shed later. (See Figs. 5 and 6*a*.)

Other somewhat longer sickle-fibres, it would appear from their length, are shed after growing for just a short time after birth. These are termed " infant sickle-fibres " (Fig. 4). Many are quite free from medulla in the short post-natal region, while a few, slightly coarser than in the neck region, have thin medulla there. Infant sickle-fibres are much less abundant than baby ones.

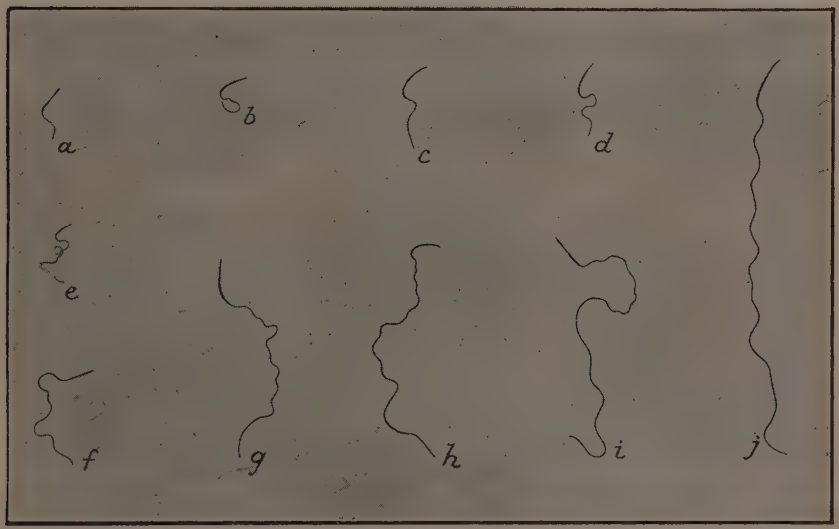

FIG. 4. BABY AND INFANT SICKLE-FIBRES. (DIAGRAMS 1·6 TIMES ACTUAL LENGTH.)

a to *f*, Baby sickle-fibres; *g*, fibre on the border-line between baby and infant sickle-fibres; *h* to *j*, infant sickle-fibres.

NOTE.—In the diagrams of fibres differences of diameter are exaggerated.

It is of course not possible to judge from post-natal material the real abundance of fibres shed before birth, but baby sickles, though loose, are clearly not readily lost from the coat for some weeks after birth. In some animals they are very plentiful. In one lamb with no halo-hairs on the back and having all the persistent sickle-fibres non-hairy after birth, baby and infant sickles were each more abundant than the other sickle-fibres. On the other hand, a search for baby sickles has sometimes failed to reveal any.

This cessation of growth of baby and infant sickle-fibres is regarded as an expression of the pre-natal check to which reference has already been made.

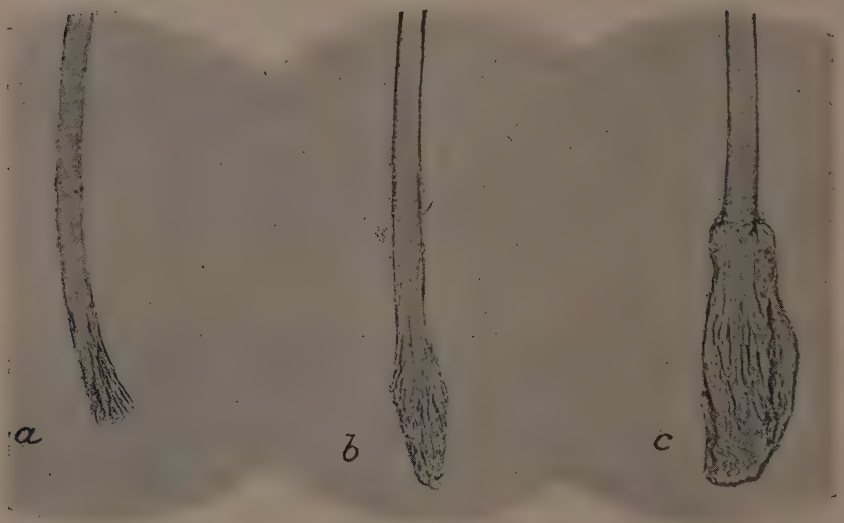

FIG. 5. BASAL ENDS OF BABY SICKLE-FIBRES. (× 200.)

a, Basal brush, the spindle-cells spread fanwise giving the appearance of a brush; *b*, basal end in the form of a club rather than of a brush; *c*, basal end enclosed in a sheath.

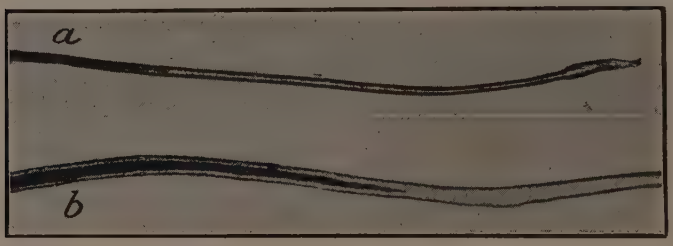

FIG. 6. DISPOSITION OF MEDULLA IN BASAL REGION OF SHED CHALKY SICKLE-FIBRES.

a, End of fibre enclosed in small sheath and medulla terminating suddenly (× 35); *b*, termination of medulla in basal region (× 70).

[*Photos by M. T. Gabriel.*

DIFFERENCES IN EARLY POST-NATAL DIAMETER AND MEDULLATION.

Sickle-fibres with a coarse, thickly medullated post-natal region were described and figured in the previous article (p. 13 and Fig 3, *h*). The change-over on the part of the follicle from producing the fine wool of the neck to putting out coarse hair is generally early and sudden, though there may be some little delay after birth. Most sickle-fibres with coarse medulla in the post-natal region sustain this up to some eight weeks after birth. For these it is convenient to use the term

"chalky sickle-fibres," from their dull white appearance. In sharp contrast stand sickle-fibres that continue to be very fine as the growth of the coat proceeds (Fig. 8). These are either entirely free from medulla or contain thin or broken medulla. They are called simply "fine sickle-fibres" (Fig. 8, *d* and *e*). In many of these it is noticeable that the fine crimping of the neck is sustained after birth. Fibres of intermediate structure are found, some being appreciably coarse after birth with medulla that is more or less fine and often patchy (Fig. 8, *b*). Less common are fibres with a short more or less coarse and medullated portion in the early post-natal region (Fig. 8, *c*).

The fineness of the fine sickle-fibres is regarded as one more expression of the pre-natal check. This will be made more clear when the different fibre-type arrays are described.

So far as the hairiness of the first fleece, at any rate, is concerned fine sickle-fibres may be left out of account. These fibres have been known to become chalky some months after birth, but for this to happen is extremely rare.

Super-sickle-fibres, some with a good deal of medulla in the neck, occasionally remain fine after birth (Fig. 8, *f*), but this is rare. Most of them become chalky.

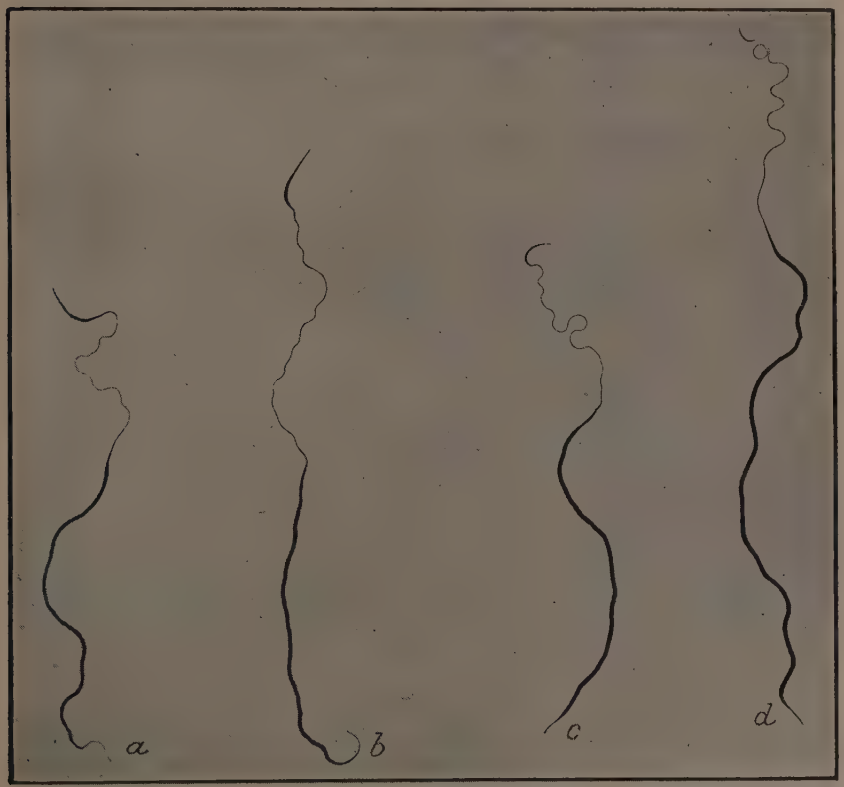

FIG. 7. SHED CHALKY SICKLE-FIBRES THAT COMPLETED THEIR GROWTH ABOUT EIGHT WEEKS AFTER BIRTH. (DIAGRAMS 1·8 TIMES ACTUAL LENGTH.)

SHEDDING OF CHALKY SICKLE-FIBRES OR PERSISTENT GROWTH.

The third month is an adventurous time for chalky sickle-fibres. They may cease growing and shortly fall out; they may show signs of stopping growing, but not do so; or they may continue their career without any indication of crisis.

Sometimes all the chalky sickle-fibres stop growing at this time, sometimes none of them, and all intermediate conditions occur. Chalky super-sickles not uncommonly persist, but on the average a bigger proportion of them than of chalky sickle-fibres is shed. Of the still larger halo-hairs practically all are shed, and for other reasons, which can be explained better when the various complete arrays of fibre types are considered, the shedding of all these kinds of fibres is looked upon as an expression of vigour on the part of their follicles.

Many chalky sickle-fibres have a medulla-free thinning in place of cessation of growth (Figs. 8, *a*, and 9, *a*), below which they are coarse again, and proportionately more of the persistent chalky super-sickles

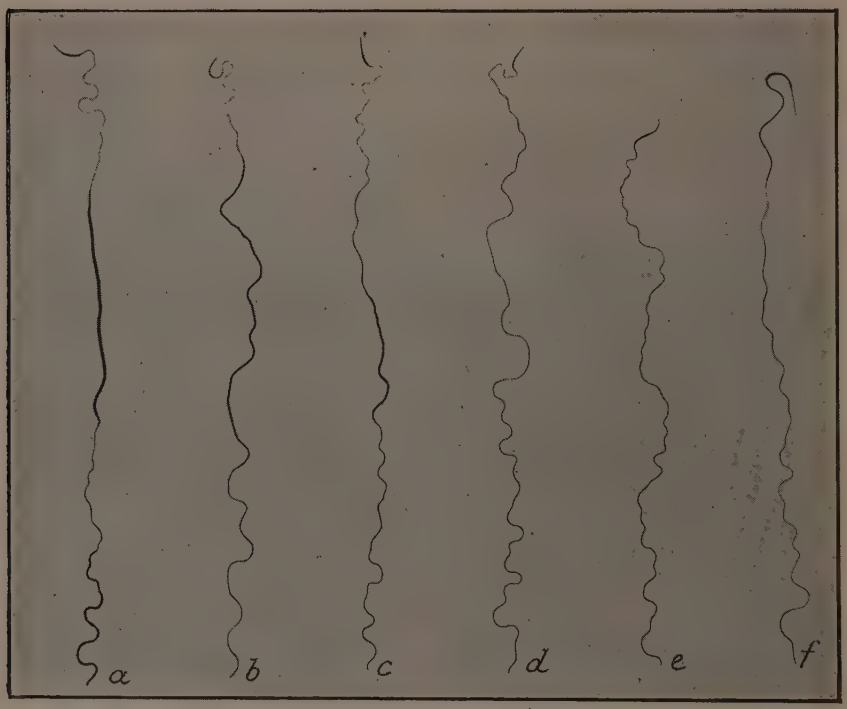

FIG. 8. PERSISTENT SICKLE-FIBRES *a* TO *e* AND SUPER-SICKLE-FIBRE *f* OF NEARLY FOUR MONTHS' GROWTH. (DIAGRAMS 1·3 TIMES ACTUAL LENGTH.)

a, Chalky with short fine region in place of shedding followed by hairy basal region; *b*, with post-natal region coarse, but not chalky, of length similar to chalky region of *a* or of a shed sickle-fibre; basally fine; *c*, with a short coarse region grown a little time after birth; other parts grown after birth fine; *d* and *e*, fine; *e*, has fine crimping throughout; *f*, super-sickle with parts grown after birth fine.

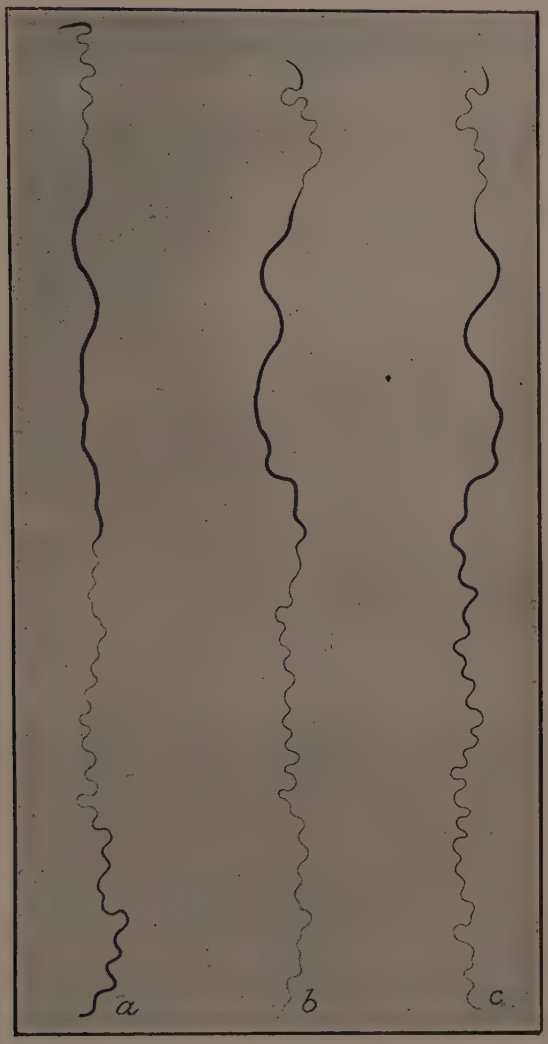

FIG. 9. PERSISTENT CHALKY SICKLE-FIBRES OF ABOUT SIX MONTHS' GROWTH. (DIAGRAMS 1·1 ACTUAL LENGTH.)

In *a* and *b* the post-natal chalky region passes suddenly into a fine region; in *a* this fine part, which is long compared with the same region in Fig. 8, *a* is followed by a coarse and hairy basal region; in *b* the fibre remains fine below the sudden thinning; in *c* the post-natal chalky region is longer than in *a* and *b* and passes gradually into the fine region, and the fibre continues fine basally.

and halos show this "crisis thinning." Often it must be touch-and-go whether a sickle-fibre falls out or persists. Many just succeed in sustaining their position, or, as one may rather say, all but make good their escape. Here it may be mentioned that while in most sickle-fibres the coarse medulla is kept up to a very short distance above

the basal brush, or club, and terminates suddenly (Fig. 6), in some the medulla tapers off more gradually, and the basal non-chalky part may be of some little length. In most cases, however, if the chalky region does not end suddenly the fibre persists.

The return to medulla production below the sudden thinning is very common in wool specimens in which hairiness in general is well sustained below this stage, while in some of these same specimens other sickle-fibres, after once going thin, remain fine right into the winter (Fig. 9, *b*). Where the hairiness of the specimen as a whole is not kept up after this stage all the persistent fibres after once being reduced in diameter may remain so. In some chalky sickle-fibres—and this often applies also to sickle-fibres that are coarse but not chalky—the coarse post-natal region is much longer than in sickle-fibres that are shed or instead become suddenly thin (Fig. 9, *c*). It is hoped to explain in discussing fibre-type arrays that the follicles of the sickle-fibres just described are to be regarded as less endowed with vigour than those of the fibres that shed, or almost shed, so that this unscathed surviving of the time of crisis is to be looked upon as the tame security of cautious mediocrity.

A study of differences in the structure and development of fibres of different parts of the body is in progress in my laboratory. It may be stated now, in connection with the shedding of sickle-fibres, that comparisons between the standard back position and the side over the last rib often show differences in the proportion of the chalky sickle-fibres that are shed in the two regions. In both positions almost all have been found shed; but often more have persisted on the side than on the back.

The later careers during the first year of sickle-fibres that become coarse after birth are very similar to those of coarse curly-tip fibres, and it is intended to deal with this phase of the life-history of both groups of fibres together, in the next article, in which also the transitions from sickle-fibres to curly-tip fibres are to be described.

The Successors of Shed Sickle-fibres.

Succession in the follicles of sickle-fibres is dealt with now in only a preliminary manner. Statements about the successors of chalky sickle-fibres are based on the dissection of skin under the microscope as well as upon the analysis of specimens of covered wool. So far as baby and infant sickles are concerned, inferences can as yet only be made from examinations that do not go below the surface of the skin. The truth of the conclusions is made more probable because a number of the lambs followed up were observed in the early days of life to be free from halos or any other birthcoat kemps projecting above the coat.

Fibres larger than baby sickles that also complete their growth by the time of birth were figured in the previous article (Fig. 4, *f* to *h*). Such shed birthcoat fibres, when it is compulsory to name them, are called "baby halos" and "baby super-sickles." There is good reason to believe that these larger baby birthcoat kemps sometimes have hairy successors, which may either be shed or persist, these being less coarse than the stoutest fibres that follow halos.

There is evidence also that baby sickles may similarly be succeeded by hairy fibres or by fine ones, and that occasionally the hairy successors

are shed. If this be so it is as if an ordinary shed chalky sickle-fibre were grown in two sections. These supposed successors sometimes keep pace with hairy fibres that have continued their growth after birth without interruption, but most commonly they lag somewhat behind. This is perhaps because the follicles have taken a little rest, perhaps because it is infants, not babies, whose place is being taken. These fibres make their presence felt most as a chalky sprinkling in a coat otherwise not hairy, but they are believed never to be very abundant. In specimens where babies and infants are plentiful by no means all of them can have had hairy followers, and sometimes none at all.

The successors of chalky sickle-fibres vary from fibres about as hairy as their predecessors to fine medulla-free fibres. It is doubtful whether these hairy successors of sickles are ever shed in the manner of kemp. There is evidence that the successors of super-sickles on the average are rather more hairy than those of sickles, and that occasionally fibres following super-sickles are shed. As is implied in the earlier article (p. 17) the follicles growing chalky sickle-fibres can be counted upon to make some permanent contribution to the hairiness of the first year's fleece.

Abundance of Sickle-fibres.

The figures now given are based on counts of the fibre types in specimens from the standard position on the back of more than twenty lambs, supported by less detailed records by Miss Galpin and myself for many more animals. What is now said applies to lambs with many halos, medium numbers, and few, though not to lambs with extremely few or none.

Apart from two exceptional animals in which halos and super-sickles were very abundant, with sickles absent in one and only a sixth as numerous as halos in the other, sickles have always been found to outnumber the halos by a wide margin, even in lambs of the many-halo class. In this class there are usually from four to twelve sickles to one halo.

Sickles are also more common than super-sickles. In a few many-halo lambs other than the two exceptional animals just mentioned the numbers of the two classes are about equal. In the other many-halo lambs sickles on the average are in a majority of four to one; in one animal the ratio was twenty to one. In lambs with few halos or medium numbers super-sickles on the average are less plentiful than in many-halo lambs, sometimes being hardly present.

A good measure of the importance of sickles and super-sickles from the point of view of hairiness is given by comparing their numbers with those of curly-tip fibres. Curly-tips on the average are six times as numerous as sickles and super-sickles combined, and this both in many-halo animals and in those also under consideration now that have fewer halos. The ratios recorded vary from 1 : 4 to 1 : 11. Comparing curly-tips and sickles proper the majority in favour of the former is about 7 : 1.

There is great variation from lamb to lamb in the proportion of sickle-fibres that are coarse and well medullated. This question will be dealt with at length when the several fibre-type arrays are described. All the sickle-fibres may be coarse and even chalky, and

almost always the coarse are in a definite majority. Fine sickle-fibres are considered very abundant when their numbers equal those of the coarse sickle-fibres, and as very much in evidence when only half so numerous, but in one animal there were four times as many fine as coarse. Variations in this proportion do not appear to be in any way connected with the comparatively small variations in the total abundance of sickle-fibres.

It has thus been found that the sickle-fibre group in lambs with more than extremely few halo-hairs is on the whole hairy. The hairiness of the curly-tip group is a more important matter, but the hairiness of curly-tip fibres varies enormously, and independently of the hairiness of sickle-fibres. It is therefore clear that the hairiness of sickle-fibres is a matter of appreciable importance.

Sickle-fibres in Lambs with no Halo-hairs.

The observations reported in the last section have shown that a lamb with quite a small sprinkling of halo-hairs is at least as likely to possess big numbers of chalky sickle-fibres as is a lamb of the many-halo class. When it comes to lambs with halo-hairs just existing on the back—a mere scattering of the order of a dozen fibres—the position may be different. Such lambs may indeed be thought of as virtually of the no-halo class, with a few accidental halo-hairs. In one such lamb a diligent search failed to discover any chalky sickle-fibres, and the fine fibres were comparatively very scarce. One cannot, however, afford the time to search long enough to guarantee the complete absence of chalky sickle-fibres over the back. A single halo-hair can be observed at a glance, but chalky sickle-fibres have to be hunted. The point is that when halo-hairs are only just present the numbers of sickle-fibres may be relatively small, and chalky ones, if there at all, extremely scarce.

In lambs entirely lacking halo-hairs on the back there is great variation in the sickle situation. Chalky sickle-fibres may be plentiful or they may be absent altogether. It is rare for them to be abundant. When present they may be shed freely or not at all. Fine sickle-fibres may be plentiful or scarce, and occasionally one can scarcely recognize any sort of sickle. Sometimes all the sickle-ends, if such indeed they be, are so small and slim that it is "splitting hairs" with a vengeance not to class as curly-tips the fibres in question. Specimens were examined from the back of seventy no-halo lambs, and in thirty of these no chalky sickle-fibres had been found after a fair search, and in many of the others, as indicated already, chalky sickle-fibres were far from plentiful. It may be added that in these no-halo lambs super-sickles were very rare, very often not being recorded at all.

Inheritance of Chalky Sickle-fibres in the No-halo Flock.

From the records of the breeding experiment, reported upon in the previous article, in which no-halo animals were mated together, a note may be added about the inheritance of chalky sickle-fibres, if indeed on so fine a point we are concerned with factors of inheritance as distinct from non-genetic conditions of development.

The animals were judged on the standard back position. On the single ram used chalky sickle-fibres were not found, and it happened

that the fine sickle-fibres had very small ends. On some of the ewes chalky sickle-fibres were found, on some not. In both these two sorts of matings offsprings were obtained that had (1) halo-hairs just present, (2) no halo-hairs but chalky sickle-fibres, (3) no halo-hairs and only fine sickle-fibres. Attention will naturally be focussed upon the fact that no-halo parents upon which chalky sickle-fibres were not found had lambs with just a few halos, and free from halos but possessing chalky sickle-fibres.

Sickle-fibres from the Practical Point of View.

This account may be concluded with a summary of the aspects of sickle-fibres in relation to hairiness, for the several features in which sickle-fibres may vary have already been listed.

Chalky sickle-fibres may accompany other kinds of hairy fibres, or they may stand out in wool in which the other fibres have little or no medulla. Not only may persistent chalky sickles make a sprinkling of hairy fibres, but so may the successors of shed chalky sickles and the fibres that are believed to take the place of shed baby and infant sickles, though by no means all the successors of the various shed sickles are hairy.

From the practical point of view fine sickle-fibres may be regarded as harmless in the first year's fleece, and whether at any later time such a fibre may revert to the original hairiness of its sickle-end has not yet been ascertained. In very few lambs lacking halos and chalky sickles is freedom from fine sickle-fibres approached.

Lambs free from halo-hairs on the back very often have few or no chalky sickle-fibres there. Rigid selection against halo-hairs does therefore tend to avoid chalky sickle-fibres, but lambs with very moderate numbers of halos are just as likely as those with big numbers to have many objectionable sickle-fibres.

The elimination of halo-hairs would thus help in the reduction of the numbers of hairy sickle-fibres. Further selection against sickle-fibres may conveniently be carried out at the same time as against the curly-tip fibres which are intended to be the subject of the next article.

Acknowledgments.

For the photographs illustrating this and the preceding article special thanks are due to Mr. H. Drake and Mr. M. T. Gabriel. The diagrammatic method of representing the fibre types is taken over from Professor J. E. Duerden.

It is desired to make acknowledgment of the support for this investigation from the Department of Scientific and Industrial Research. This help was especially useful in providing assistance for teaching, and so allowing more time for wool research.

Control of Aphides on Vegetables, &c.—Mr. W. K. Dallas, Horticulture Division, states that good results have been obtained in the control of aphides on vegetables and other garden plants by the use of a summer oil emulsion at a dilution of 1 part to 100 parts of water. The spray has not only cleaned up the aphides, but has also improved the health of the plants when a summer oil emulsion containing ammonia has been used.

SOME SOILS OF THE TARANAKI DISTRICT.

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FOREWORD.

As one would expect from the topography and situation of Taranaki relative to the sea, exposed to the prevailing south-westerly winds off the ocean, the climate is characterized by high rainfall and large number of rain days. According to Dr. Kidson's publication on the average annual rainfall in New Zealand from 1891 to 1925 (Government Printer, 1930) no part of Taranaki receives less than 40 in. of rain annually, while the greater portion has from 60 in. to 100 in., the greatest rainfall, 100 in. to 200 in., being received by that forested mountain area on Mount Egmont, while the alpine area above the bush-line, 6,000–7,000 ft., receives as much as 200 in. The number of rain days of the greater part of Taranaki is above 150, while the area including Mount Egmont and Cape Egmont is as high as 175 days.

High rainfall, coupled with a large number of rain days and strong winds off the Tasman Sea carrying salt in suspension, together with a soil derived from volcanic rock (andesite) rich in plant-food and with a temperature which allows grass to grow throughout the year marks the land as extremely suitable for agriculture, particularly dairy-farming. The salts contributed by the sea winds, chlorides and sulphates of sodium, magnesium, potash, and calcium no doubt aid their indirect fertilizing effect by assisting in the disintegration of the rock-matter, and in making and keeping available the soil phosphates and those added as artificial fertilizers and as manures from stock.

The high rainfall and great number of rain days indicates that a most suitable fertilizer to use is basic slag. Invercargill district (total 40 in. to 50 in.), for instance, in the far South, has 175 to 200 rain days a year and uses much slag, whereas Canterbury with only 100 to 125 rain days (total rainfall 20 in. to 30 in.) uses little or no slag.

The andesitic dust or mud showers which form the highly fertile loam soils on the borders of Taranaki, notably at Waverley, are naturally rich in plant-food, as shown by the analysis of unmanured soil from Moumahaki, which contained 0·44 per cent. total phosphoric acid and 0·03 per cent. available, 0·65 per cent. of nitrogen, 0·015 per cent. available potash, and 1·47 per cent. calcium carbonate, while the subsoil contained 0·53 per cent. total phosphoric acid and 0·23 per cent. available phosphoric acid, 0·26 per cent. nitrogen.

A large amount of valuable information on Taranaki has been published by the Geological Survey (see Bulletin No. 14, 1912, by Clarke, and No. 29, 1927, by Morgan and Gibson). In the former an analysis of Taranaki rock is given where it appears that even the parent rock may contain as much as 0·39 per cent. of phosphoric acid, and the famous Taranaki black ironsand, which is a soil-former of great importance in some portions of Taranaki and the border lands, contains from 0·03 per cent. to 0·09 per cent. phosphoric acid. A large amount of the geological work of Taranaki has been no doubt stimulated by the occurrence of petroleum.

The hilly country of central and northern Taranaki, after it has been cleared of its forest covering and partly grassed, shows a strong tendency to revert to fern and second growth, but these lands are largely derived from a non-volcanic rock. The soils of the volcanic areas are eminently suited to the production of market-garden crops on a large scale.

The pastures of Taranaki have been the subject of an extended investigation for mineral content, mainly to determine whether any correlation could be established between the chemical or botanical composition of pastures and the occurrence of certain troubles in dairy stock, notably temporary sterility (see this *Journal* for August, 1930, pp. 94–97).

There are indications that the high rainfall and great number of rain days are necessary in obtaining the best results under Taranaki soil conditions, and that if by any chance a drought occurs the pastures fail to absorb the required amount of phosphoric acid, and malnutrition or untimely falling-off of milk-yield in cattle occurs. It is to be noted that "Waihi" disease or phosphate deficiency in cattle takes its name from the district in Taranaki where this disease was first observed.

—B. C. Aston, Chief Chemist, Department of Agriculture.

THE SOILS AND THEIR ANALYSES.

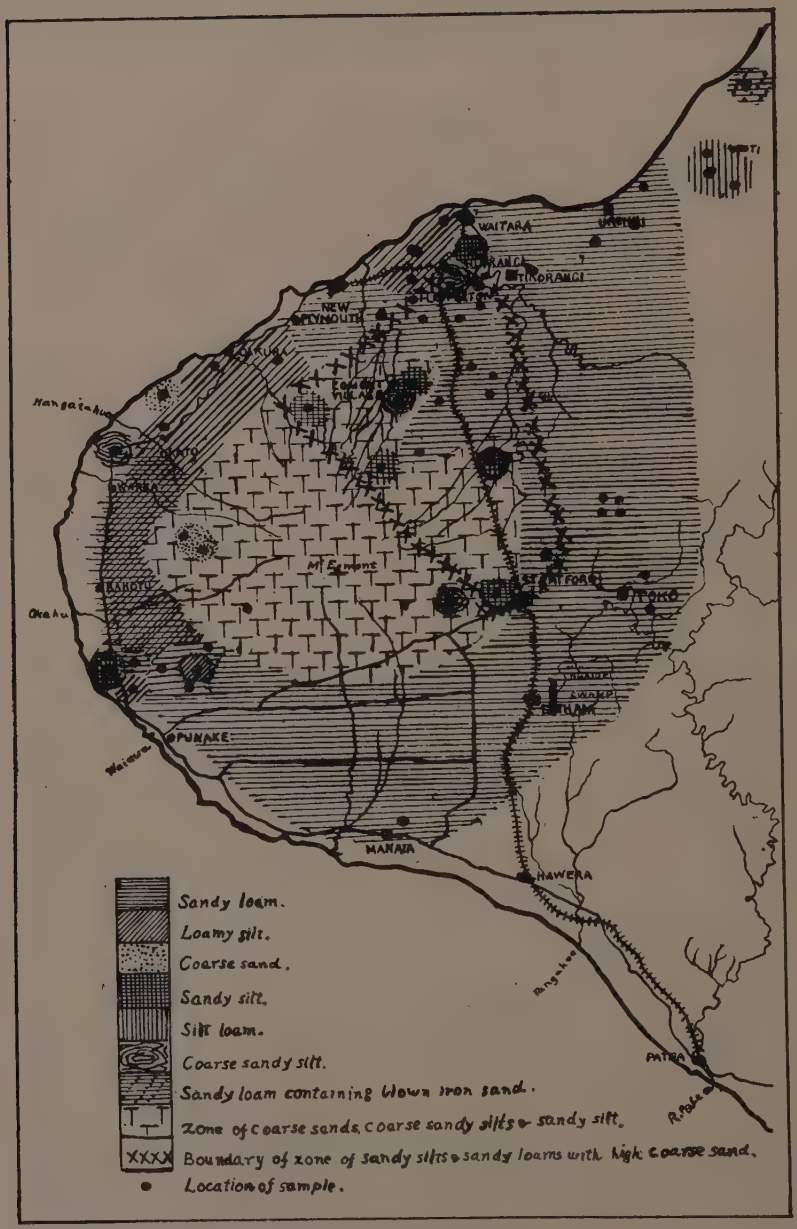
In connection with an investigation, conducted jointly with the Live-stock Division, into temporary sterility of dairy cows and other live-stock troubles in the Taranaki District*, a considerable number of soil-samples were analysed between 1929 and 1932. Fairly complete data were available in most cases concerning the previous history, manuring, and productive capacity of the farms studied, and it is felt that, together with the analysis of the soils and the distribution of the soil-types concerned, the information will prove of value to farming practice in the area, which includes some of the most productive dairying country in the Dominion.

The soils of Taranaki within a radius of forty miles of Mount Egmont are derived principally from volcanic ash ejected by that mountain. For the first twelve to fifteen miles, travelling outwards, scoria and lapilli are easily visible in the soil, and are present in sufficient quantity to cause it to be classified, texturally, among soils of coarse nature, such as coarse sand and sandy silt. A considerable part of this zone lies within the confines of the Egmont National Park, and is consequently not farmed, while where farming is being conducted the altitude is so high (1,000 ft. to 2,000 ft.) and rain so frequent, that the soil rarely dries out, enabling dairying to be carried on where otherwise semi-desert conditions would prevail.

Outside this zone is a second zone of finer ash, where the soils are fairly uniformly of a sandy loam texture, which though not very retentive of moisture, is admirably suited for growth of pasture, allowing extensive root-development, in a district where rainfall is usually heavy and well distributed. On the outer edge of this zone, particularly near the coast, soils of more varied type are encountered.

The field evidence suggests that during the eruption of Egmont from which the present topsoils are chiefly derived strong westerly winds were blowing, distributing the material far inland to the east. To the west and north-west of the mountain the zoning appears to be narrower. Between Okato and Oakura, also near Opunake and between New Plymouth and Waitara, loam soils are found which may represent the finer dust from the periphery of the cloud of ash. In many cases along the coast blown sand (Taranaki black ironsand)

* See this *Journal* for August, 1930, p. 94.



MAP OF PORTION OF TARANAKI DISTRICT DEALT WITH IN THIS ARTICLE.
Location of soil-samples indicated by dots.

from the beaches overlies or is mixed with the subaerial ash, forming soils of fine sandy loam, coarse sandy silt, or coarse sand texture. From Uruti northwards the country is hilly and broken, and much of the ash, which has also originally fallen in a thinner layer, has slumped into the valleys, exposing the underlying mudstones (papa) or sandstones. The mixing of sedimentary and volcanic materials has given rise to soils of much finer and more sticky nature, such as silt loams.

In the accompanying soil map soils of sandy silt or coarser texture have been grouped within the light shaded zone, while the zone of sandy loams is indicated by dark shading. A third zone, which appears to be superimposed on the other two, comprising sandy silts and sandy loams containing an unusually high proportion of coarse sand, is indicated by a shaded outline. This zone, which extends from Stratford to Waitara and south-westward towards Mount Egmont, is probably the result of a thin layer of fine scoria from a (geologically) very recent eruption, which has been distributed by a south-west wind over the country to the north-west of the vent.

The soils on the whole are very similar in chemical composition, the only exceptions being the silt loams from the vicinity of Uruti, which contain much larger amounts of potash soluble in hydrochloric acid, and are much more acid in reaction than the typical volcanic soils. The hydrogen-ion concentration of the Uruti soils examined is 5·2–5·3 compared with an average of 6·0 for the typical soils.

A characteristic feature is the large amount of lime and magnesia soluble in hydrochloric acid. "Total" phosphoric acid is in most cases present in considerable quantity (in one soil reaching the high figure of 0·32 per cent.), but there are indications that the availability as measured by the citric solubility is in some instances somewhat low, even where intensive manuring has been the rule. With regard to available plant-food other than phosphorus, it will be seen that lime and magnesia are present in adequate amounts, while potash in some soils is rather low. This is perhaps slightly more noticeable in the coarser types. As would be expected from the large amounts of organic matter indicated by the loss on ignition, the soils are rich in nitrogen. No marked correlation between chemical and mechanical composition is apparent.

REMARKS ON SAMPLES IN TABLE OF ANALYSES (PAGES 158 AND 159).

Z/1082. Opua Road, Opunake: Flattish country near sea, poor herbage; in pasture four years and top-dressed annually with 2½ cwt. slag; temporary sterility considerable; herd average 1·17 lb. butterfat per day.

Z/1084. Leith Road, Okato: Undulating country close to sea; in pasture ten years, with 4 cwt. basic super and 5 cwt. slag after sowing; top-dressed annually with 3 cwt. super; rich pasture; no sterility; herd average 1·03 lb. butterfat.

Z/1086. Leith Road, Okato: Adjacent to sea; top-dressed annually with 2½ cwt. slag; sterility of recent occurrence.

Z/1088. Fitzroy, New Plymouth: Flattish country; in pasture twelve years; manured annually 2½ cwt. slag; sterility high.

Z/1090. Bell Block: In pasture number of years; top-dressed for last two years with 3 cwt. slag in autumn; sterility high; herd average 1·01 lb.

Z/1092. Brixton: Flats close to sea; rich pasture, sown nine years; top-dressed annually with 2–3 cwt. slag or super; four years ago had 5 cwt. lime; no sterility.

Chemical Analyses of Taranaki Soils.

Results, except * and pH, are percentages on soil dried at 100° C.

Laboratory No.	Locality and Soil Texture.	Volatile Matter.			Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method, Hall's Modification. ("Available Plant-food.")				Hydrochloric-acid Extract. ("Total Plant-food.")				Lime-requirement, % $CaCO_3$.		pH.
		*On Air-drying.	*At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	On Air-dried Soil.	On Soil dried at 100° C.	
Z/908	Omata : Loamy silt	32·3	9·1	23·2	0·599	0·162	0·054	0·011	0·011	1·64	0·74	0·09	0·25	0·52	0·57	5·9
Z/910	Tumahu : Coarse sand	14·3	3·6	12·8	0·342	0·180	0·044	0·008	0·027	2·79	0·84	0·11	0·16	0·40	0·41	5·8
Z/912	Westown, New Plymouth : Sandy loam	33·9	6·4	20·5	0·610	0·235	0·066	0·010	0·007	1·88	0·74	0·10	0·27	0·42	0·45	6·1
Z/914	Frankley Road, New Plymouth : Sandy silt	27·6	6·6	19·0	0·483	0·047	0·040	0·008	0·012	1·86	0·80	0·11	0·16	0·57	0·60	5·7
Z/916	Henwood Road, Bell Block : Sandy loam	29·9	8·4	22·6	0·627	0·208	0·034	0·008	0·006	1·89	0·86	0·10	0·17	0·46	0·50	6·3
Z/920	Uruti : Silt loam	25·0	3·0	9·8	0·261	0·154	0·042	0·010	0·015	1·42	1·56	0·84	0·11	0·24	0·25	5·2
Z/922	Uruti : Silt loam	26·7	2·3	10·0	0·276	0·119	0·036	0·011	0·017	1·37	1·44	0·71	0·13	0·35	0·36	5·3
Z/924	Waitoitoi : Sandy loam	26·3	13·8	25·1	0·697	0·176	0·042	0·015	0·006	1·29	0·56	0·08	0·24	0·51	0·59	5·7
Z/926	Waitoitoi : Sandy loam	21·8	12·0	24·6	0·658	0·108	0·040	0·016	0·008	1·40	0·82	0·09	0·15	0·56	0·64	5·5
Z/928	Pukearuhe : Sandy loam (containing blown ironsand)	24·2	9·3	22·9	0·662	0·148	0·033	0·011	0·010	1·29	0·80	0·08	0·16	0·57	0·63	5·6
Z/930	Lepperton : Coarse sandy silt ..	25·8	5·6	18·9	0·552	0·219	0·034	0·008	0·010	1·91	0·78	0·09	0·20	0·40	0·42	6·3
Z/932	Inglewood : Sandy loam	30·2	8·5	21·8	0·581	0·125	0·021	0·011	0·010	1·84	0·78	0·09	0·20	0·47	0·50	5·9
Z/934	Egmont Village : Coarse sandy silt ..	25·0	8·1	19·6	0·555	0·119	0·021	0·009	0·013	1·98	1·04	0·10	0·18	0·45	0·49	5·9
Z/996	Toko : Sandy loam*	24·2	5·5	17·7	0·537	0·170	0·029	0·009	0·010	1·75	0·68	0·11	0·28	0·32	0·34	6·1
Z/998	Cardiff : Coarse sandy silt	18·5	3·9	13·5	0·422	0·134	0·020	0·007	0·034	2·44	0·96	0·13	0·20	0·30	0·31	5·6
Z/1000	Oaonui : Sandy loam	26·7	4·2	18·4	0·567	0·241	0·051	0·012	0·016	2·31	0·58	0·11	0·19	0·39	0·41	6·1
Z/1002	Oaonui : Sandy loam	18·7	14·4	18·4	0·529	0·230	0·048	0·010	0·005	1·72	0·54	0·07	0·18	0·29	0·34	6·5
Z/1004	Opunake : Sandy loam	28·6	7·6	21·3	0·506	0·242	0·056	0·011	0·010	1·99	0·74	0·10	0·15	0·42	0·45	6·2
Z/1076	Kaimiro, Inglewood : Sandy silt ..	31·4	6·5	17·2	0·501	0·083	0·014	0·016	0·023	3·03	1·08	0·16	0·17	0·41	0·44	5·7
Z/1078	Dudley Road, Inglewood : Sandy loam*	27·1	5·1	21·1	0·666	0·124	0·031	0·014	0·013	2·15	1·00	0·13	0·22	0·38	0·40	5·8
Z/1080	Oaonui : Sandy silt	29·3	7·8	20·5	0·626	0·147	0·046	0·010	0·014	1·89	0·68	0·12	0·28	0·46	0·50	6·0
Z/1082	Opua Road, Opunake : Loamy silt ..	23·8	8·1	20·6	0·692	0·218	0·068	0·022	0·013	2·05	0·68	0·15	0·27	0·30	0·33	6·0
Z/1084	Leith Road, Okato : Loamy silt ..	31·3	9·2	25·9	0·854	0·186	0·055	0·011	0·011	1·45	0·72	0·10	0·30	0·59	0·64	6·0
Z/1086	Leith Road, Okato : Coarse sand ..	12·0	3·4	10·6	0·363	0·170	0·031	0·009	0·032	2·35	0·94	0·13	0·17	0·28	0·29	5·9
Z/1088	Fitzroy, New Plymouth : Sandy loam ..	31·6	7·7	22·3	0·728	0·278	0·042	0·009	0·010	2·12	0·70	0·11	0·21	0·35	0·38	6·3

CHEMICAL ANALYSES OF TARANAKI SOILS—*continued.*

Laboratory No.	Locality and Soil Texture.	Volatile Matter.			Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method, Hall's Modification. ("Available Plant-food.")				Hydrochloric-acid Extract. ("Total Plant-food.")				Lime-requirement, % $CaCO_3$.		pH.
		*On Air-drying.	*At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	On Air-dried Soil.	On Soil dried at 100° C.	
Z/1090	Bell Block : Loamy silt	28·0	8·1	20·7	0·697	0·132	0·033	0·015	0·008	0·72	0·55	0·11	0·18	0·55	0·60	5·8
Z/1092	Brixton, New Plymouth : Loamy silt ..	20·6	8·0	21·1	0·634	0·186	0·052	0·022	0·012	1·66	0·74	0·12	0·21	0·53	0·57	5·9
Z/1094	Tarurutangi : Sandy loam*	13·0	11·3	24·1	0·594	0·198	0·044	0·015	0·016	1·93	0·80	0·11	0·22	0·44	0·50	5·9
Z/1096	Waitara Road, Brixton : Sandy silt ..	12·9	11·7	24·2	0·724	0·165	0·042	0·009	0·012	1·52	0·74	0·08	0·28	0·52	0·58	6·1
Z/1098	Lepperton : Sandy loam	18·3	10·3	19·4	0·573	0·142	0·029	0·010	0·009	1·75	0·82	0·09	0·25	0·39	0·43	6·1
Z/669	Tikorangi : Sandy loam (top) ..	..	13·4	23·9	0·510	0·164	0·037	0·013	0·010	1·85	0·82	0·06	0·16	0·57	0·66	..
Z/670	Tikorangi : Sandy loam (sub) ..	..	9·6	18·3	0·499	0·092	0·027	0·011	0·006	1·55	0·68	0·11	0·15	0·58	0·64	..
Z/671	Urenui : Sandy loam (top)	..	9·6	25·9	0·849	0·167	0·054	0·021	0·009	1·67	0·72	0·11	0·15	0·75	0·83	..
Z/672	Urenui : Sandy loam (sub)	..	14·0	18·7	0·469	0·088	0·030	0·010	0·004	1·39	0·60	0·08	0·10	0·51	0·59	..
Z/1100	Lincoln Road, Inglewood : Sandy loam*	23·1	10·5	19·7	0·577	0·161	0·030	0·016	0·010	1·70	0·74	0·10	0·18	0·46	0·51	6·2
Z/1102	Tariki : Sandy silt	20·0	16·1	19·7	0·670	0·104	0·021	0·012	0·016	1·85	0·88	0·10	0·21	0·44	0·52	5·7
Z/1103A	Inglewood : Sandy loam	18·3	18·7	21·6	0·755	0·136	0·019	0·012	0·027	1·82	0·88	0·15	0·18	0·47	0·58	5·7
Z/1104	Inglewood : Sandy loam*	22·5	10·6	17·3	0·673	0·116	0·022	0·009	0·023	2·01	0·86	0·12	0·22	0·42	0·47	6·0
Z/2002	Tuna : Sandy loam	22·2	4·6	21·5	0·704	0·178	0·027	0·015	0·015	1·61	0·66	0·11	0·24	0·46	0·49	5·8
Z/2004	Toko : Sandy loam	26·3	5·2	18·2	0·625	0·268	0·025	0·023	0·010	1·83	0·72	0·16	0·32	0·32	0·34	6·2
A/19	Tumahu : Coarse sand	21·5	4·6	18·9	0·555	0·141	0·027	0·009	0·017	1·89	0·86	0·09	0·16	0·37	0·39	5·7
A/21	Opunake : Sandy loam	22·2	4·7	18·1	0·562	0·235	0·041	0·011	0·010	2·03	0·74	0·10	0·23	0·46	0·48	6·3
A/23	Opunake : Loamy silt	29·4	4·9	26·3	0·643	0·285	0·054	0·015	0·005	1·27	0·49	0·08	0·13	0·48	0·51	6·2
A/113	Oakura : Loamy silt..	23·4	8·4	23·7	0·682	0·187	0·061	0·011	0·007	1·17	0·55	0·08	0·21	0·48	0·52	6·2
A/115	Huirangi : Sandy loam	20·6	6·2	20·7	0·637	0·115	0·034	0·014	0·008	1·55	0·74	0·09	0·18	0·54	0·57	6·0
A/120	Cardiff : Sandy silt	26·6	3·4	16·1	0·538	0·109	0·026	0·009	0·025	2·12	0·88	0·12	0·24	0·48	0·49	5·6

* Unusually high in coarse sand.

NOTE. — pH 7 indicates neutrality ; figures above 7 indicate degrees of alkalinity ; figures below 7 indicate degrees of acidity (the smaller the number below 7 the more acid the soil).

Z/1094. Tarurutangi: In pasture twenty-five years; top-dressed annually for last ten years with 3 cwt. slag and super used alternate years; Waihi disease seven years ago; some sterility; herd average 1·03 lb.

Z/1096. Waitara Road, Brixton: Flat country; rich pasture, sown nine years; top-dressed annually 3½–5 cwt. slag and some potash; thirty-six cows; 290 lb. average butterfat per year; sterility high.

Z/1098. Lepperton: In pasture number of years; top-dressed last three years only with 5 cwt. slag annually; no sterility.

Z/1100. Lincoln Road, Inglewood: In pasture seven years; top-dressed annually for past five years with 3 cwt. super and slag alternate years; temporary sterility high; bone-chewing noted.

Z/1102. Rugby Road, Tariki: In pasture twenty years; top-dressed last three years with 3 cwt. slag or super; sterility bad.

Z/1103A. Upper Dudley Road, Inglewood: In grass number of years; still in stumps; top-dressed last three years with 3–4 cwt. super or slag; no sterility.

Z/1104. Inglewood: In grass five years; top-dressed annually with 4 cwt. super and slag alternately; sterility bad; Waihi disease at one time; average production about 300 lb. butterfat per year.

Z/1996. Uruti: Silt loam, alluvial flats; rich pasture sown fifteen years; top-dressed annually 2½ cwt. slag; sterility slight; production high.

Z/1998. Lepperton: Sandy loam (high in coarse sand); in pasture nine years; top-dressed annually with 3 cwt. slag but last top-dressing was 3 cwt. slag, 4 cwt. basic super, and 3 cwt. guano; no sterility.

Z/2000. Egmont Village: Sandy silt; old pasture; top-dressed annually 2½ cwt. slag; temporary sterility high, probably infection.

Z/2002. Tuna, Midhirst: Sown fifteen years; top-dressed last seven years annually with 2 cwt. slag; temporary sterility slight; herd average 1·04 lb.

Z/2004. Toko: Undulating hills, with poor patchy pasture; temporary and permanent sterility high.

A/19. Tumahu: Well up towards Mountain on west side; contains lapilli; in pasture ten years; top-dressed annually 3 cwt. slag and a little potash used; temporary sterility low; production high.

A/21. Ihaia Road, Opunake: Boulders of lava, hummocky soil; top-dressed last four years with 2½ cwt. slag annually; poor pasture, weedy; temporary sterility high; herd average 0·93 lb.

A/23. Opua Road, Opunake: Swampy unploughed flats, with iron hard-pan; top-dressed several times with 2½ cwt. slag; temporary sterility high; herd average 0·96 lb.

A/113. Oakura: Old pasture, poor and weedy; down twelve years; top-dressed 3 cwt. super or slag annually; recently 6 cwt. lime; temporary sterility moderate.

A/115. Huirangi: In pasture twelve years; top-dressed annually alternately with 2–3 cwt. slag, super, blood and bone; sterility slight.

A/120. Cardiff: High altitude; old pasture, top-dressed annually with 3 cwt. super and slag in alternate years; temporary sterility moderate to high; herd average 1·1 lb.

Z/669. Tikorangi, near Waitara: Top-dressed annually with 3–4 cwt. super or slag, also a little lime, potash, and sulphate of ammonia; temporary sterility high; production fair.

Z/671. Urenui: Top-dressed with 3–4 cwt. slag or super annually for five years; sterility moderate.

Z/908. Omata, near sea: Has had total of 8 cwt. super, 25 cwt. slag, 5 cwt. burnt lime, and 3 cwt. potash; temporary sterility recent only; volcanic soil.

Z/910. Tumahu: Sandy flats, probably resorted by water; in pasture four years; top-dressed annually 3 cwt. slag, also a little potash; very little sterility; high production.

Z/912. Westown, New Plymouth: Terraced flats, flat land; present pasture four years old; top-dressed annually with 3–5 cwt. various mixtures, mainly super, basic super, potash, lime, and blood and bone; temporary sterility two years; production high.

Z/914. Frankley Road, New Plymouth: High altitude, poor pasture; manured three times with 3 cwt. slag, but not for two years; Waihi disease, and absence of oestrum; temporary sterility high.

Z/916. Henwood Road, Bell Block: Hay paddock near stream; pasture top-dressed for six years annually with 3–6 cwt. super or slag; no sterility.

Z/918. Bell Block: Loamy silt, undulating; pasture top-dressed annually for past five years with 2–3 cwt. super or slag, and a little potash; temporary sterility for some years.

Z/920. Uruti: Papa soil, alluvial flats, rich pasture; sown four years; top-dressed annually with 1½–3 cwt. super or slag; temporary sterility moderate; production high.

Z/922. Uruti: Papa, alluvial flats, rich pasture, top-dressed annually for twelve years with 3 cwt. slag; temporary sterility low; production high.

Z/924. Waitoitoi: Lawn-like, rotationally grazed pasture; top-dressed during recent years with 2½ cwt. slag in autumn, 2½ cwt. super in spring, and 1 cwt. sulphate of ammonia in July; temporary sterility low; production high.

Z/926. Waitoitoi: Near sea, old pasture; top-dressed during last three years with 3 cwt. slag annually, also a little super; temporary sterility low; production high.

Z/928. Pukearuhe: Flats adjacent to sea; soil mixed with blown ironsand; in pasture 10 years; top-dressed annually with 5 cwt. super or slag; temporary sterility moderate; production high.

Z/930. Lepperton: In pasture ten years; top-dressed annually 2 cwt. slag; damp, low-lying, with hardpan; temporary sterility high.

Z/932. Inglewood: Hilly, in pasture 12 years; top-dressed biennially with 3 cwt. slag, but last dressing lime and super; temporary sterility low; production medium.

Z/934. Egmont Village: Near Mountain, contains lapilli; old pasture; top-dressed annually with 2½ cwt. slag; temporary sterility slight; production moderate.

Z/996. Toko: Hill pasture, sown six years, top-dressed annually with 3 cwt. slag or super; temporary sterility high.

Z/998. Waingongoro Road, Cardiff: 2,000 ft. elevation; in pasture five years; top-dressed annually with 3 cwt. slag; temporary sterility moderate; herd average 1·2 lb.

Z/1000. Oaonui: Swampy land with iron hardpan; in pasture five years; manured each year with 3 cwt. slag; temporary sterility high; herd average low.

Z/1002. Oaonui: Pasture poor and weedy, sown eight years; top-dressed annually with 3 cwt. slag or Nauru phosphate; temporary sterility high; herd average 1·06 lb.

Z/1004. Opua Road, Opunake: Boulders of lava in soil, hummocky, unploughed pasture fifteen years old; top-dressed three or four times with 2 cwt. slag; temporary sterility moderate; herd average 0·91 lb.

Z/1076. Kaimiro, Inglewood: High altitude, in pasture six years; top-dressed annually with 2 cwt. super and 2 cwt. slag; temporary sterility slight; herd average 1·04 lb.

Z/1078. Dudley Road, Inglewood: In pasture nine years; top-dressed with 4 cwt. super and 4 cwt. slag in alternate years; temporary sterility slight; herd average 1·20 lb.

Z/1080. Oaonui: Undulating country; in pasture seven years; top-dressed annually with 2 cwt. slag, and with super three years ago; temporary sterility moderate; herd average 1·18 lb.

Acknowledgment is made to Mr. W. M. Webster, Veterinarian, Live-stock Division, New Plymouth, for assistance in the field and for help in obtaining figures relating to herd production and sterility. The chemical analyses tabulated are by F. J. A. Brogan and D. F. Waters; the mechanical analyses by E. B. Davies and F. A. Denz.

Colouring Sodium Chlorate Spray.—Slaked lime, carbonate of lime, whiting, or chalk, in sufficient quantity, may each be used to colour the solution of sodium chlorate in connection with the spraying of noxious weeds. By this means the area treated can be readily determined during the course of operations.

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H. Allan, Systematic Botanist, Plant Research Station, Palmerston North.

The last published list of plants naturalized in New Zealand is that in Cheeseman's "Manual of the New Zealand Flora, 1925." This list is inaccurate in several respects, especially in that a number of species are incorrectly named. Further, since 1925 a number of exotic plants not there mentioned have been observed in a thoroughly naturalized state. Some of these are of considerable importance, and this series of articles is designed to draw attention to their characteristics.

The earlier one has information of the incoming of an alien the better chance one has of preventing its spread. The policy should be to attack the enemy during his efforts to land, not to wait till he is thoroughly entrenched. It is therefore a pleasure to acknowledge the assistance rendered to me by many correspondents, both official and private, in my studies of the alien flora. Unfortunately, many of the species under consideration have evidently been taking hold for a number of years, unmarked and unheeded. While comparatively few, perhaps, are likely to be serious nuisances, it is better to be over cautious than utterly neglectful.

(1) Eupatorium.

This genus belongs to the composite family—*i.e.*, the group of plants having flowers arranged in heads as in the daisies. It contains some 600 species, their headquarters being Mexico, the West Indies, and tropical South America. A number have become well-known garden plants under the name mist flower; others have been grown for their reputed medicinal qualities. Escaping from gardens certain of these have shown undesirable qualities from the farmer's point of view. Examples are joe-pye weed, boneset, thoroughwort, and white snake-root, which have spread through several of the United States of America. Some members of the genus, notably boneset and white snake-root, have been suspected of causing disease in stock, though experimental feedings have failed to establish this. The plants are not at all palatable, and are very unlikely to be touched by stock except when in an extreme state of hunger.

Two species have become well established in the northern parts of North Island, though till recently they have not attracted attention. These are *Eupatorium riparium* and *E. glandulosum*. Both are natives of Mexico, and both are grown in gardens to some extent for the sake of their abundant ageratum-like white flowers produced in open clusters. The illustration (Fig. 1), coupled with the following description, will serve to distinguish them.

E. riparium, Mist Flower: A low, diffuse plant; stem rather woody at the base, slender, reddish; leaves lance-shaped, taper-pointed, in opposite pairs; flower-clusters on long slender stalks.

E. glandulosum, of similar diffuse habit, but more robust; when growing in masses it may be more erect, up to 6 ft. tall; stems stouter, usually darker in colour, covered with sticky, glandular hairs; leaves broader, shorter-pointed, flower-clusters denser, on stouter stalks.

FIG. 1. (RIGHT) EUPATORIUM RIPARIUM; (LEFT) E. GLANDULOSUM.
[*Photo by H. Drake.*

E. riparium has merits as a garden plant, but has escaped from gardens in several localities in the Auckland District, and is well-established in some places—*e.g.*, near Russell, Bay of Islands. It does not spread very rapidly, is easy to control, and is not likely to give any serious trouble.

E. glandulosum has become rampant in several localities, and is occasioning some concern. It was first brought to my notice by the Inspectors of Stock at Thames and at Whangarei, and later Mr. M. Hodgson, of Auckland, informed me it had covered several acres on Rangitoto Island.

On the Coromandel Peninsula a number of patches of considerable size have been noted, and the plant is tending rapidly to increase its area, owing to its rapid growth, profuse flowering, and free seeding. It favours damaged forest and bush-burn country, but is also at home on river-beds and encroaches on pasture land. It grows luxuriantly and forms dense thickets, very difficult to deal with if allowed to get away.

FIG. 2. PORTION OF THICKET OF E. GLANDULOSUM ON RANGITOTO ISLAND, AUCKLAND. NOTE ROOT-SYSTEM.
[*Photo by L. M. Cranwell.*

In the neighbourhood of Whangarei the weed has also proved very aggressive. Mr. W. M. Fraser, Engineer to the Whangarei Harbour Board, has kindly forwarded me information supplementing my own observations. The plant's habits are the same at Whangarei as at Coromandel, but it has not yet made such extensive thickets. Mr. Fraser writes: "In this county it has already made its appearance on the roadsides and adjacent lands in the districts of Maungakarama, Whareora–Horahora, and Kiripaka. In shady places on good land the plant grows to a height of 6 ft. or 8 ft., while in exposed positions on grassland it attains a height of from a few inches to 2 ft. It may be found growing in any location from the highest dry hill to the wettest raupo swamp, and although it prefers the sheltered edges of bush it thrives well on open pastoral lands." He adds: "Eupatorium is easily recognizable in spring-time by its white flowers and stinking

leaves, and on account of its shallow rooting-system can, when the ground is wet, be easily pulled out." He suggests "Mexican Devil" as an appropriate name.

On Rangitoto Island Mr. Hodgson discovered a thicket covering several acres, and another large area has since been found. As seen in the illustration (Fig. 2) the plant is perfectly at home among the lava-blocks, particularly where the original cover of pohutukawa has been destroyed by fire. The specimen held aloft well shows the extensive but shallow root-system. Thanks to the energy of the Devonport Domain Board a strenuous attempt is being made to control the plant on this unique scenic reserve. The patch shown in the illustration has been completely pulled out, but vigilant watch and continued effort will be necessary if this alien is to be banished.

It will be evident from the foregoing that where thickets of *E. glandulosum* have already become established control is difficult and laborious. It should not be difficult to prevent the spread of the weed on well-managed pastures, provided the plant is discovered in the early stages of its colonization. It has been suggested that the weed should be declared "noxious"; it is more important that the danger should be recognized of its actually becoming noxious on certain classes of pastoral land in the North, so that control measures may be taken early, when the chances of success are good.

(Series to be continued.)

SEED-POTATO CERTIFICATION.

SOME OBSERVATIONS MADE DURING FIVE YEARS' OPERATIONS.

J. H. Claridge, Assistant in Agronomy, Plant Research Station, Department of Agriculture, Palmerston North.

Seed-potato certification was inaugurated by the New Zealand Department of Agriculture in 1927. Now, after five years, in reviewing the progress made, it is possible to draw certain conclusions of general interest, and such is the purpose of the present article.

In the certification of seed potatoes an attempt has been made to select those crops which attain a reasonable standard of purity and freedom from virus diseases. Uniformity of grading, freedom from tuber diseases such as scab and dry-rot, and other factors of this kind also receive consideration before a line can be finally certified. It was early realized that the dominant factor influencing yield was the presence in the crop of virus diseases, such as leaf-roll and mosaic. These diseases are not soil-borne. They are transmitted in the field from plant to plant, and are carried over in the seed from year to year. Their presence results in a marked decrease in the yielding ability of a line.

It has been the practice in certification to make cropping power and virus counts the most important factors in deciding upon the acceptance or rejection of crops. All cropping-power figures used in this article have been obtained from the certification trials.

In these trials samples from the different lines entered for certification are grown under uniform conditions, so that comparisons of yield may be made between the lines. The tubers of each line are dug and graded into "table," "seed," and "small." The weights of the table and seed potatoes are obtained. The cropping-power is then determined by adding half the weight of the seed tubers to the weight of the table tubers and converting this figure into "tons per acre." In order to overcome the difficulty of variation in yield from season to season, the cropping-powers of each individual season are so adjusted that the best lines give a figure of approximately 10 tons per acre of cropping-power. Virus counts are also made in the samples, the figures obtained being used as a check on the virus counts made in the field.

In this article points of interest on which observations are made are: (1) The relationship between virus and cropping-power; (2) comparisons between certified and non-certified seed; (3) the distribution of certified seed; (4) the variation in deterioration of lines when grown under different conditions; (5) the improvement in yield of crops entering certification; (6) the purity of crops in relationship to certification.

Relationship of Virus to Cropping-power.

In Table 1 the results of growing 281 samples of the Dakota variety are recorded. The trials cover a period of five years, and demonstrate conclusively that the cropping-power is inversely proportionate to the degree of virus infection. There are other factors, such as size of seed and condition of seed when planted, which have some small effect on the cropping power, but the table demonstrates that the question of virus infection is by far the most important. A similar table is obtained when the figures for any other variety are analysed in like manner.

Table 1.—Comparison between Virus Percentage and Cropping-power in 281 Lines of Dakota Potatoes.

Number of Crops in Group.	Cropping-power Group. (Tons per Acre.)	Percentage of Plants infected with Virus Disease.
14	Over 10·0	10·9
14	9·5–9·9	11·4
16	9·0–9·4	13·0
34	8·5–8·9	12·6
26	8·0–8–4	15·0
33	7·5–7·9	15·9
32	7·0–7·4	17·0
26	6·5–6·9	20·0
29	6·0–6·4	27·0
15	5·5–5·9	31·0
21	5·0–5·4	33·0
6	4·5–4·9	41·0
3	4·0–4·4	46·0
5	3·5–3·9	59·0
1	3·0–3·4	50·0
4	2·5–2·9	67·0
1	2·0–2·4	70·0
1	1·5–1·9	79·0

Certified versus Non-certified Seed.

From the foregoing remarks it may be inferred that the main difference between certified and non-certified seed consists in the ability of the seed to yield. While it is quite possible that occasionally a line of uncertified seed may yield equally as well as certified seed, the advantage to be gained from the use of certified seed has been demonstrated time and again under a very wide range of conditions of climate, season, and soil. Also it should be realized that such productive lines cannot be recognized by merely inspecting the seed. On the average, from the results of trials carried out by the Department of Agriculture, the grower of certified seed may expect a 25 per cent. greater yield than the grower of uncertified seed. This is taking into account the fact that some lines of uncertified seed might come up to certification standard were they placed under trial.

A series of experiments was conducted by the Department during 1929–30 to demonstrate the difference between lines of seed which were of certification standard and lines of seed below certification. Twenty-three trials were carried out in six centres in the South Island. The varieties used were Up-to-Date, Dakota, Aucklander Short Top, and Epicure. The seed for the trials was obtained from the certification plots of the previous season. The seed-size tubers of the one-third highest-yielding lines of a variety were bulked together, and the third lowest-yielding lines were similarly treated. These tubers formed the material for comparison. The average yields over the whole series resulted in an increase of $3\frac{1}{3}$ tons per acre from the certified seed, which represents an increase of 64 per cent. At the same time the proportion of virus-diseased plants in the seed from the rejected lines was nearly twice that in the seed from the passed lines.

Distribution of Certified Seed.

Certification has performed a most valuable service in stimulating the distribution of high-quality seed to replace much of the poor seed that has been used in the past.

For the purpose of illustrating this point, use is again made of the Dakota variety. One grower entered his crop in 1927–28, and the line was considered one of the best in the certification trials of that season. During the last two seasons, over 50 per cent. of the Dakota crops entered can be traced back to this one crop certified in 1927–28. The figures in Table 2 (next page) record the number of entries in each season which could be traced back to the original crop, and the percentage of the total number of Dakota entries received.

The case in point is an extreme one so far as distribution is concerned, but is an excellent example of what is possible under a combination of certification and good marketing. As a more typical example, it may be mentioned that all the eighty-seven Dakota crops passed in the last two seasons can without exception be traced back to four original lines entered since the commencement of certification.

Table 2.—Illustrating Distribution of Certified Seed.

Season.	Number of Crops traced back to Original Crop.	Percentage of Total Number of Dakota Entries received.
1927–28	1	4
1928–29	3	9
1929–30	25	23
1930–31	53	57
1931–32	23	46
Totals.. ..	105	33

By certifying annually some 800 acres of potatoes it is estimated that sufficient seed could be produced by the second season following to sow the whole of the Dominion's acreage of potatoes. Therefore if growers were to aim at planting seed as little removed as possible from certification, theoretically they should never have to plant seed which was more than two seasons removed from certified stock.

Deterioration of Lines.

It has been mentioned that 105 entries of the Dakota variety can be traced back to the one original line. This line has been entered in each of the five seasons under review, while thirty-six entries have been received of seed supplied to other growers from this line. Thus in all forty-one samples of seed produced by the original grower have been under trial, and all have reached certification standard. It may therefore be concluded that in this case there has been no deterioration over a period of five years.

Thirty-five entries were received from growers whose seed had been grown away from the original farm during one season. Of these, twenty-two reached certification standard, while thirteen were rejected. Of twenty-seven entries representing seed which had been grown away from the original farm for two seasons, twelve entries were passed and fifteen rejected. Two entries representing seed grown three times away from the original line were both rejected. Thus it would appear that the farther removed from the original crop the seed became the greater was the chance of the seed having deteriorated to below certification standard. It should be noted that in seventeen cases two or more growers had purchased seed from the same line. In sixteen of these cases lines of seed originating from identical crops in the previous season were all either passed or rejected. In only one case did both passed and rejected samples originate from the same crop in the previous season.

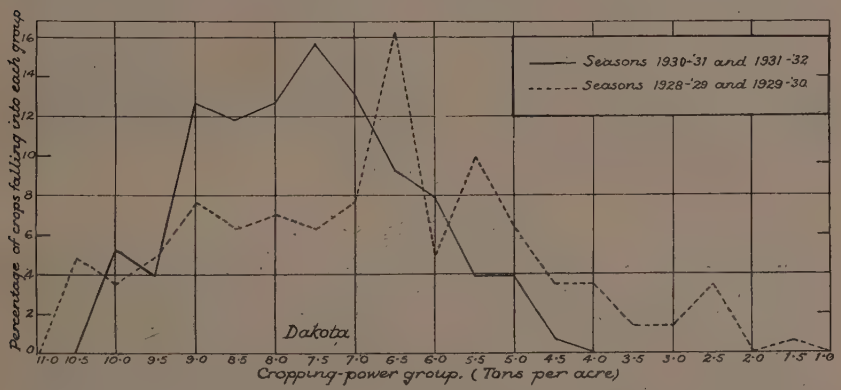
From an analysis of the districts where the lines have been grown away from the original farm it is indicated that deterioration has been most marked in the Temuka, Washdyke, and Seadown districts of Canterbury. Only three out of eight entries of seed once grown in this area were passed, and these three were rejected in the following season after twice growing in the locality. On the other hand, the district running from Templeton to Rakaia produced lines which on the average showed little deterioration. These

remarks should not be taken as conclusive, as they are indicative only of the particular districts mentioned, and other localities not represented in the trials may be more or less suitable to the checking of deterioration due to virus disease.

It may be concluded from these results that when the original line is of a high standard, that standard may or may not be maintained, depending on the conditions under which the line is grown in subsequent years.

Improvement in Crops entering Certification.

The accompanying graph serves to illustrate the general improvement that has taken place in the cropping-powers of lines entered for certification. Comparison is made between the two seasons 1928–29 and 1929–30, and those of 1930–31 and 1931–32. The figures have been taken from the Dakota variety, as being one of the most important varieties in New Zealand at the present time.


Seasons 1930-'31 and 1931-'32
Seasons 1928-'29 and 1929-'30
Dakota
Percentage of crops falling into each group
Cropping-power group. (Tons per acre)
11·0 10·5 10·0 9·5 9·0 8·5 8·0 7·5 7·0 6·5 6·0 5·5 5·0 4·5 4·0 3·5 3·0 2·5 2·0 1·5 1·0

GRAPH SHOWING PERCENTAGE OF CROPS OF DAKOTA POTATOES FALLING IN EACH CROPPING-POWER GROUP, SEASONS 1928–30 AND 1930–32.

The following features are worth noting: (1) In the 1928–29 and 1929–30 seasons the majority of the crops fall about the average; there are a few good crops, while there are a number of poor crops tailing off below the average. (2) In the 1930–31 and 1931–32 seasons the bulk of these poor crops have been eliminated, the growers of these in many cases having purchased certified seed. There is also a decided improvement in the general average of the cropping-power, associated with an increase in the number of good crops. This may be attributed directly to the effect of certification in drawing attention to the better-class crops, and so stimulating their distribution and re-entry into certification.

Purity of Crops.

The standard of purity in certification allows for not more than 2 per cent. of foreign varieties. During the first three seasons 24·6 per cent. of the crops were rejected on this account. In the last two seasons the proportion has averaged 5·2 per cent., a result indicating the direct influence of certification.

The question of purity is on the whole not a vital factor in potato certification. There is only one variety—Northern Star—which is a serious "rogue" in white-skinned varieties. Northern Star under normal conditions throws more seed-size tubers than any other variety. Hence, under the usual practice of selecting the smaller tubers for planting, the percentage of plants of this variety, if present at all in the line, is bound to increase. Cases have been common of a line of potatoes containing, say, 2 per cent. of Northern Star rogues in one season, and in the following season showing an increase to 4 per cent. No other variety when present as a rogue has been noticed to show any appreciable increase over two or even more seasons. Therefore, when once a reasonably pure line has been obtained, there is every chance of its remaining reasonably pure provided mixing does not occur.

A source of mixing not generally realized is the practice of planting potatoes on land which produced a crop of a different variety in a previous season. In this respect Northern Star is again the worst offender. Cases are on record on a pure line of potatoes, sown on land which had grown a crop of Northern Stars two seasons previously, showing a percentage of 5 to 10 per cent. of these rogues present. So far as coloured-skinned potatoes are concerned, no variety has shown any tendency to increase appreciably when present as a rogue in other varieties.

Conclusions in Brief.

The yield of the potato crop is reduced in proportion as the percentage of virus infection increases.

Certified seed may be expected to yield in the neighbourhood of 25 per cent. better than uncertified seed.

Certification is of great value in that it results in the rapid distribution of the better lines of seed potatoes.

A line which yields well in one season will not necessarily retain its high cropping-power indefinitely. Virus disease may or may not spread, and therefore the cropping-power may or may not be affected, depending upon the conditions under which the line is grown.

There has been a general improvement in the quality of the crops entering certification, brought about by the stimulation given to the distribution of the good lines and the suppression of the poor ones.

The question of purity is closely linked up with the Northern Star variety. Provided a grower exercises reasonable care to prevent mixing of lines, and is able to identify and remove any Northern Stars present in his crop, he should have no difficulty in maintaining a pure line of seed.

Noxious Weed Order.—The Weber County Council has declared milk thistle, otherwise known as variegated thistle, to be a noxious weed within that county.

SEASONAL NOTES.

THE FARM.

Pasture Top-dressing Considerations.

In general the top-dressing of the past was credited with having caused much less benefit than it actually did cause. If the farming community had possessed an accurate knowledge of the past profits from judicious top-dressing many farmers would have adopted more extensive programmes, and some who did no top-dressing would assuredly have considered it worthy of a place in their farm practice. The recent regrettable reduction in top-dressing is largely due to this past failure to measure accurately its true function in our farming.

While, unfortunately, it must be admitted that some, because of their financial position, are not top-dressing as extensively as they believe they should, it is known that others could profitably spend more on top-dressing than they are spending, but refrain from doing this because they erroneously believe that the extra expenditure would not result in enough benefit to justify it.

Confused thinking frequently underlies unduly restricted expenditure on top-dressing. Some, for instance, would readily affirm that top-dressing would increase their production substantially, but at the same time they contend that they would be unwise to seek an increased production in view of the fact that they are already losing money on each pound of butterfat or on each lamb they produce. In certain circumstances such thinking may be sound; more often it is unsound. This is because an increased production due to top-dressing is frequently associated with a cost of production lowered to such an extent that a working loss is turned into a profit, or at least lessened. Judicious top-dressing has at times been the primary cause of increases of 25 per cent. to 50 per cent. in production. How such happenings may affect unprofitable farming is indicated by the fact that it is better to lose 1½d. a pound on an output of 15,000 lb. of butterfat than 2d. a pound on an output of 12,000 lb., and it is also better to lose 1d. a pound on 18,000 lb. of butterfat than 1½d. a pound on 15,000 lb. These figures indicate that even when a farm is being run at a loss top-dressing may directly affect production in such a way as to be well justified. Normally when a farm is being run at a profit the justification for top-dressing becomes more readily obvious.

It is confused thinking also to look upon top-dressing merely as a means of bringing about increased production; on thousands of farms it is the essential means of avoiding decreased production. Hence, a farmer who does not seek to increase his production may still need to top-dress more freely than he plans. Top-dressing viewed as a maintenance measure is of special moment this season to those who, having top-dressed for some seasons, carried it out on a reduced scale last season. Under normal grazing much of our grassland if not top-dressed suitably at regular intervals would steadily deteriorate. An important feature of the process of deterioration is that it is at times insidious, and hence may go unnoticed until costly damage has occurred. The farmer who sees his pastures every day is not always well equipped by training or experience to note the relatively insignificant gradual changes in them, which, taken over a year or two, amount to serious deterioration. The residual influence of previous top-dressing is particularly apt to create in farmers who have reduced their programme an unfortunate belief that their grassland is not being detrimentally affected by discontinuance of top-dressing. At times farmers

who had been regularly applying liberal dressings of superphosphate or of other phosphates have discontinued top-dressing for a season, and for that season the carrying-capacity has not always been greatly affected; but the immediate effect on the carrying-capacity does not necessarily, or even probably, reflect the ultimate effect of not top-dressing grassland the quality of which has been built up partially by earlier top-dressing. The earlier top-dressing has created reserves of fertility which represent part of the current capital value of the farm, and a type of management which does not provide for the replacement of these reserves simply means utilizing capital instead of income.

From these considerations it follows that a farmer in deciding upon his top-dressing programme should often be interested not so much in the extent to which a given amount of top-dressing will increase next season's production over that of last season's, but in how much the production two seasons hence will decline if top-dressing is not carried out.

It is well to bear in mind that top-dressing does not require to be more effective in order to be profitable now that produce brings lower prices. This is largely due to the fact that top-dressing has not remained a fixed charge in face of the decline on farm-produce values. As superphosphate is of outstanding importance in top-dressing it is of some interest that about a dozen years ago when butterfat was returning from 1s. 2d. to 1s. 5d. a pound super cost £8 15s. a ton on trucks. This is not substantially different from butterfat at 8d. a pound and super at £4 a ton. On the basis of these figures it will be found that there is to-day no necessity that top-dressing shall produce very remarkable results in order to be effective enough to be worth while. Dairying well exemplifies this. Increases of over 40 lb. of butterfat an acre, due primarily to top-dressing at the rate of 2 cwt. to 3 cwt. an acre, are far from uncommon. To-day an increase of 40 lb. of butterfat an acre, due to the dressing specified, costs about 12s. an acre. At 8d. a pound for butterfat it returns £1 6s. 8d. an acre. An increase of 20 lb. of fat an acre for an expenditure of 12s. would return 13s. 4d. an acre. If a suitable dressing of 2 to 3 cwt. an acre does not result in an increase in production of 20 lb. of fat an acre and at the same time obviate deterioration of the pastures, then, provided the management is reasonably efficient, the land probably should not be devoted to dairying to-day.

When financial factors prohibit the carrying-out of a full top-dressing programme it is advisable to do as much as can be financed instead of eliminating it altogether, and when only a portion of a farm is to be treated it is advisable, as a rule, to top-dress the fields supporting the better swards; then the influence of the fertilizer is exerted on a greater number of the more valuable pasture plants, which have a greater capacity of responding usefully to improved fertility than have the inferior plants and weeds which are more prominent on the poorer swards.

In general, the first result to be sought in top-dressing is increase in the supply of phosphates. Successful results in the field have well justified the very general use of superphosphate. It has been stated previously in these notes that super does not cause any permanent increase in soil-acidity, and this view is authoritatively confirmed in the following statement in "Artificial Fertilizers in Modern Agriculture," published in 1931, and written by Sir John Russell, Director of Rothamsted and of the Imperial Bureau of Soil Science: "The old statement that superphosphate tended to exhaust the lime and to make the soil acid is incorrect . . . Shortly after its application it may act like any other neutral salt in intensifying the effects of soil-acidity . . . but the ultimate effect is very small, and may even be in the direction of reducing the acidity."

Over wide areas with fairly heavy rainfall slag is known to give good results, and in districts of good rainfall African and similar phosphates

may be expected to prove satisfactory, but, instead of using these latter phosphates alone, when a quick result from top-dressing is desired it is usually advisable to employ a mixture consisting of equal weights of one of them and of super.

In a few districts official field trials have given evidence of benefit from the use of potash on grassland, and in such districts farmers are justified in fairly extensive trial use of this fertilizer. The available evidence indicates that the use of potash should be linked with the use of phosphates, for in the soils of the districts concerned there is apparently a deficiency both of phosphates and of potash, and if the phosphate position is not improved the use of potash alone may be expected to be unsatisfactory. Apart from the particular districts to which reference has been made, the evidence available does not justify a general recommendation to use potash in top-dressing. The material known as 30-per-cent. potash salt is, as a rule, the most economical source of potash for grassland.

On farms in which a shortage of winter feed for dairy animals is expected it may prove profitable to apply a soluble mitrogenous manure, such as sulphate of ammonia or nitrate of soda, in late March or April, at the rate of about 1 cwt. an acre, as a means of increasing the supply of feed. The use of such nitrogenous fertilizers alone is seldom satisfactory, and to get satisfactory results phosphates should be applied at the same time as, or shortly before, the nitrogenous material. The best results from nitrogenous manures follow their application to vigorous well-drained pastures in which rye-grass is prominent.

Liming.

Those who desire to reduce their expenditure on top-dressing are inclined at times to resort to liming as a cheap substitute for phosphates. Unfortunately, this may be expected almost always to prove a very unsatisfactory substitute, for while there is a considerable area on which a mixture of lime and superphosphate gives attractive results the area on which satisfactory results from lime alone are evident is very restricted.

The results from liming in New Zealand are so variable that money should be spent cautiously on it in those areas which do not present reliable conclusive evidence that liming is profitable. If land does not respond satisfactorily to standard dressings of phosphates, then lime is well worth a trial in association with the phosphates. Apart from field trials, no methods of ascertaining the amount of lime that may profitably be applied to land have been shown to be reliable.

Autumn Management of Pastures.

Wherever top-dressing is known to be beneficial a special effort should be made to dress newly established grass. At times young pastures deteriorate rapidly because of a slight initial lack of fertility, and, as a rule, it is better to prevent this by timely suitable top-dressing than later on to renew or repair deteriorated swards.

Autumn harrowing of pastures is widely advisable, and should be done thoroughly enough to bring about even distribution of droppings, which, when so treated, have a considerable fertilizing value, and which if left undisturbed bring about deterioration instead of improvement of the sward.

Seed Treatments of Cereals.

Commonly occurring smuts of wheat, oats, and barley may be controlled effectively by suitable treatment of the seed prior to sowing, and yet these smuts annually cause substantial losses in the crops of the Dominion.

Stinking smut of wheat is spread by minute parts of the parasite, causing it being deposited on the outside of the grains to be used as seed. Hence seed from a healthy crop may become contaminated with

the disease by contact with sacks or machinery which have held a diseased crop, and so, to be on the safe side, even when using seed from a healthy crop, it is usually worth while suitably to treat the seed against smut. The dry-dusting of wheat seed with fine copper carbonate powder as a means of controlling stinking smut has been widely recommended not only in New Zealand, but in leading overseas wheat-growing countries. In favour of the copper-carbonate treatment it may be pointed out that it is very effective, it involves no danger of injury to the seed, it may be done at any convenient time and at a considerable interval prior to sowing if desired, and it favourably compares in point of expense with other methods of treatment. The harmful effect of inhaling the powdered carbonate in any considerable quantity cannot be overlooked, and on this account farmers should use a proper dustproof mixing-apparatus for treating seed or should obtain treated seed from merchants. (Certain materials which are prepared for the dry-dusting of wheat seed, and which are sold under trade names such as Ceresan, are referred to in a separate article in this issue by the Field Mycologist.)

When the dry-dusting treatment is not to be employed formalin may be used with good result. An effective way is as follows: Add 1 pint of good formalin to 60 gallons of water; wet the seed thoroughly with the solution by sprinking the seed and then shovelling it about on a clean floor. Then pile the seed into a heap, cover the heap with sacks soaked in formalin solution of the strength already mentioned, and leave the heap covered with the sacks overnight. The seed should be sown while still damp; if it dries out a considerable loss in germination may result. To avoid reinfection with the smut put the treated seed in sacks which have been soaked in the formalin solution.

Another effective way of treating seed wheat is the following: Add 1 pint of good formalin to 40 gallons of water. Have sacks one-third full of seed and preferably sewn instead of tied. For ten minutes immerse each sack in the formalin solution, keeping the grain in the sack well agitated by lifting one corner after another. Then place the sacks on ground where there is no danger of freezing and spread the grain evenly by flattening out the sacks. Seed treated thus overnight is ready for sowing the next morning, and cannot be kept long without injury. This method of treatment may be employed successfully for the control of smut in barley and oats, for which dusting with copper carbonate is not satisfactory.

General Cropping Work.

In the main South Island wheat-growing districts autumn and early winter form the ideal sowing season for wheat, which fares best on a fine firm seed-bed. Experience has shown that over a wide range of country wheat responds well to a dressing of 1 cwt. of superphosphate to the acre.

For winter and spring feed, oats (which may possibly be utilized for grain or chaff), should be sown not later than April or early May. Generally they respond profitably to 1 to 2 cwt. an acre of manure in which superphosphate is prominent. If the land has been under cultivation for a considerable period some nitrogenous fertilizer such as sulphate of ammonia may prove profitable as a supplement to the phosphate.

Any available green maize or millet should be turned into silage or hay before the first frosts occur. If a weight of green material sufficient to avoid undue loss in saving is on hand, silage is to be preferred to hay.

At times the growth made by lucerne during the latter part of the season is grazed. The trampling resulting from such grazing favours grass, and so as a rule the grazing is inimical to the lucerne. This is especially so in districts of good rainfall, in which grasses often are the worst weeds troubling lucerne.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Fruit Export Work.

BEFORE these notes are published the harvesting of mid-season varieties of apples and pears will be in full swing, and from now on until the end of the export season the orchardist will have little time or thought for anything outside the picking, packing, grading, and forwarding of fruit for shipment overseas. The systematic orchardist will be well prepared for this period of the season by having everything in readiness well before harvesting activities commence. If this is done (and there are a hundred and one large and small jobs that can be done) much confusion and time will be saved when the rush of work commences.

In picking all varieties of fruit there are two main essentials that must be kept prominently under the picker's observation—colour requirements and stage of maturity. There should be no great difficulty as regards colour requirements, as they are defined each year according to variety under the conditions of Government guarantee for the season. Stage of maturity is governed by one or two factors, the chief of these being a distinct change of ground colour from green to light yellow. One cannot overemphasize the need for careful handling of fruit for export, both in the orchard and in the packing-shed. In the orchard much damage is caused by rough handling in so far as the fruit is carelessly pulled from the tree by force, which usually results not only in finger bruises on the fruit but also in the stem of the fruit being often left behind, thus rendering it unfit for export. This can be obviated to a great extent by the picker taking hold of the fruit with the whole hand (not just the thumb and first finger as is usual) and giving it a sharp upwards turn.

Then, again, overfilling the picking-bag, dropping the fruit carelessly into the bag, and carelessly transferring it therefrom to the orchard case, will and does cause much damage to the fruit and financial loss to the grower.

Cool-storing for the Local Market.

Fruit intended for cool store for the local market should be as carefully handled as that intended for export. It has been proved without any possible doubt that only good sound fruit can be expected to keep in cool store over a long period. It is futile to cool-store any fruit the epidermis of which has been broken and expect it to come out as sound as it went in. Storage rots take an exceedingly heavy toll annually of fruit placed in cool store. Fortunately, however, rots such as pink-rot and blue-mould, &c., can only make an entrance through a broken skin such as insect puncture, and skin broken at the stem, &c.

Spraying Operations.

Growers are advised not to suspend their applications of arsenate of lead at too early a date. Codlin moth and leaf-roller caterpillar are usually still active well into April, and it is therefore advisable to continue with the arsenical applications until a few weeks prior to picking.

As the danger from black-spot infection is not yet passed it is advisable to continue with fungicidal sprays for a while longer. Where brown-rot fungus was troublesome a careful examination should be made, and all mummified fruits removed from the trees and ground and destroyed by burning. In addition to this an application of bordeaux 5–4–50 is recommended, as soon as possible after the fruit has been picked, as a partial controllant of the disease.

Orchardists should thoroughly investigate the results obtained during the season from the spraying compounds used and the methods employed in preparation and application. When unsatisfactory results are obtained something is wrong. Factors which contribute to success are the thorough

applications of sprays at the correct times, use of the correct compounds, proper mixing of sprays, and an elementary knowledge of the life-history of pests and diseases.

—J. W. Whelan, Orchard Instructor, Palmerston North.

Citrus Culture.

Since the last month's citrus notes were written very copious rains have fallen, and the trees will rapidly put forth new growth. This growth will be very soft and tender, and likely to suffer injury from frosts during the winter. For this reason nitrogenous fertilizers should not be used now, as they will tend to make the growth more succulent. It is recommended, therefore, to use potassic or phosphatic fertilizers, which will have a hardening effect, and will in some measure help the trees to withstand the winter.

Citrus groves in general materially benefit by an application of lime. Where no lime has been applied for years a dressing of 1 ton per acre will be advisable, and this should be followed by a dressing of about ½ ton per acre every third year. The lime should not be ploughed under, but rather sown upon the surface of the soil after ploughing has been completed. The best time to do this is after the soil has been turned up for the winter.

While the main crop is developing is a good time for a general overhaul of the trees, thinning out of any exhausted wood, cutting out suckers or water shoots, and trimming the lower branches in order to keep them well above the level of the soil. It may be necessary to remove any accumulation of soil from around the trunks, so as to minimize the danger of collar-rot. Any low areas from which water does not drain quickly should receive attention, as stagnant water is detrimental to the trees.

If cover-crops have not already been sown no time should be lost in getting them in. Growth will be fairly rapid during the next two months, and the crops should supply a good body of material for ploughing under. It is essential that means such as this be taken to keep up the supply of organic matter in the soil, as it is the base of almost all plant-life. There is quite a range of seeds that can be sown, such as lupins, peas, beans, and tares, all of which produce a fair volume of material for ploughing under. Where Lotus angustissimus (hispidus) is found this makes one of the best for the purpose, and when established it comes up each year without any seed having to be sown.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Selection of the Breeding Hens.

In successful poultry-keeping there is a time for everything, and March may be regarded as the best period of the year for selecting the most desirable hens for the breeding-pens. While lateness of moulting is one of the best indications of productive powers, the fact that the best layer is not necessarily the best breeder cannot be too strongly emphasized. In making such a statement it must not be implied that I am departing from the stand I have always taken that the late moulter is the more desirable bird to breed from, but this view has been expressed in a general sense. The best breeder is always a late moulter, but the late moulter, as previously mentioned, is not necessarily always a desirable bird to breed from.

Type and constitution are the two great factors to be considered. It is not uncommon to see a bird (even in an egg-laying competition) of good laying type and of undoubted productive capacity, but which, in the opinion of a practical poultryman, would be regarded as an undesirable

breeder, simply because she had been bred too fine, and was a mere weed. Obviously, the use of such a hen to perpetuate the species would be simply inviting degeneration and a loss of laying-power in the flock.

Recently I inspected a flock of heavy layers which gave evidence that they would be long-season producers and consequently late moulters, but I could not point to a single desirable breeder among them. They were all weeds, and in no way conformed to the standard-weight clauses of their breed, while a glance into the next boxes went to show that the great majority of the eggs produced were well below the desired 2-oz. standard. It was easy to foresee that if birds of such a type were consistently bred from it would not be many years before they would degenerate into bantams, and thereby produce a decidedly low-grade product.

The faculty of being able to select an ideal breeder is not given to every man, even though he may have a fair eye for laying form or be possessed of birds with individual egg-performance. It is often stated there is no such thing as desired type, and the egg record is the only thing to go by. Of course this is a fallacy, but too much stress may easily be laid on judging by form, just as equally great mistakes may be made by attaching too much importance to the egg record. The ideal breeding-hen must conform to the laying-type, must have pronounced constitutional characteristics, and, if possible, a good egg-laying performance behind her, and be descended from a known family of purebred heavy-egg producers. There is still something more required,—namely, the possession of good bodily development; in other words, the bird must conform to the standard weight of the breed she represents, and in addition be a producer of at least a 2 oz. egg.

I would again emphasize the importance of selecting the prospective breeding-pens before the moulting process sets in, as it is practically impossible to accurately judge the value of any character in a fowl during any stage of the moulting process.

Tuberculosis.

Reports to hand indicate that tuberculosis, or what is usually termed by poultrymen "going light," has made its appearance on several plants in different parts of the Dominion. Fortunately, this dreaded disease is by no means so common in fowls as it used to be. Indeed, it is safe to say that for every one notification received by me during recent years regarding flocks being affected, at least fifty were reported twenty-five years ago. This satisfactory decrease is undoubtedly due to a better realization among poultry-keepers generally that prevention is the only way of successfully dealing with the disease. This implies in the first place the breeding of stock possessing strong constitutional vigour, in order that the birds have the resistance to combat the infection should they come into contact with it. Next in importance is that great essential cleanliness, and clean quarters and surroundings must go hand in hand with good feeding—a plentiful supply of good, nourishing food. Fresh air in the sleeping quarters, is also specially important if the disease is to be kept off, but it should be remembered that airy quarters do not imply a draughty building.

Tuberculosis is mostly found where the birds are accommodated in insanitary, ill-ventilated buildings, and are kept year after year on stale ground which is never turned up to the influence of the sun, sown down, and allowed to rest. On such plants, moreoever, the birds are seldom fed and attended to as they should be. It should always be remembered that fresh air and sunshine are the greatest enemies of this disease. It should not be thought that the disease affects only old birds, for young stock, even during the brooder stage, may easily become affected if they come into contact with the infection.

Most other troubles which affect poultry can be easily checked if taken in time, but not so with tuberculosis, and where it appears in a

flock there is no telling when it will be effectively stamped out. The excreta of a diseased bird contain large numbers of the tuberculosis germ, and it will be easily understood that the food, &c., may be contaminated and a healthy bird become affected. It is useless trying to doctor a bird affected with tuberculosis—prevention is the one and only safe course.

Should there be any indication of the presence of this highly infectious disease the suspected cases should be isolated and placed in a clean house. If any of these birds are subsequently found to be affected they should be promptly destroyed and the carcasses burnt. If possible, the whole of the birds in the run where the affected birds came from should be removed to fresh clean quarters, and the place and everything connected with it should be thoroughly cleaned and sprayed with a strong disinfectant, the run being dug up, given an application of lime, sown down, and allowed to rest. If this is not possible or convenient, and the house is as it should be, roomy and well ventilated, the birds should be confined to the house until the disease is stamped out. In this way the source of infection is not only reduced, but a good opportunity is also afforded for turning the run over and sowing it down as a means of sweetening it. It goes without saying that this and other diseases which affect poultry can be more easily prevented and controlled where a concrete floor is used, chiefly for the reason that the cleaning and spraying operations can be more effectively carried out than with an earth floor. The risks of infection may also be minimized by providing all the food in troughs.

Usually, the first outward symptom of tuberculosis is an unhealthy appearance and a rapid wasting of flesh, which is most noticeable around the breast-bone, the latter standing out as a sharp ridge. It will also be observed that the bird has a listless appearance and seldom mixes with other members of the flock. As the disease advances a yellow and in some cases a mixed green diarrhœa sets in. Another common symptom is a limp, generally on the right leg. Under post-mortem examination the liver will usually be found spotted with yellow nodules, and for this reason the disease is often known by poultry-keepers as "spotted liver."

I would again emphasize that prevention is the only effective means of fighting this disease, and in this connection too much emphasis cannot be placed upon the value of cleanliness, good feeding, and well-ventilated houses, while, above all, strong constitutional vigour must be maintained in the flock to resist the infection.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Autumn Management.

In case all surplus honey has not been removed by the time these notes appear beekeepers would be well advised to use bee-escapes, as indicated in last month's notes. There is a grave risk of starting robbing unless extreme care is exercised in removing honey so late in the season. However, the use of bee-escapes will, with ordinary care, enable his operations to be completed in comfort and without the interference of robber bees, which are particularly active at the close of the flow.

In some districts after the autumn rains a small flow of honey may be experienced, sufficient to meet the daily needs of the colony, with some to store for winter food. It is well, however, to make sure that the colonies have a sufficient supply of honey on hand to winter well; thus an estimate of stores should be made when the remainder of the surplus is taken. In most districts it is good practice to leave not less than

40 lb. of honey for each colony's requirements, while in some districts 60 lb. will be a safer estimate. It must be remembered that it is in autumn the beekeeper is laying the foundation for the next season's crop; therefore he should concentrate in wintering his bees well. The three main factors to be observed are strong colonies, abundance of stores, and queen-right hives.

As the season advances supers not fully occupied by the bees should be removed and stored away.

Uniting Colonies.

As advised last month, all weak and queenless hives should be united. The golden rule of modern beekeeping is to keep all colonies strong, and this applies specially to the autumn months, when weak colonies are in danger of being robbed. If by any chance late swarming and weak colonies from defective queens have to be dealt with the procedure recommended is as follows: After taking the roof and mat from a queen-right hive, place a sheet of newspaper immediately over the top of the frames and carefully place the queenless colony on top. Little smoke will be required if the colony is gently handled. Weak colonies should be similarly treated. There is no need to remove one of the queens, as the bees will decide which they will keep.

Robbing.

Robbing is the result of carelessness, and once it has started is exceedingly hard to check. Do not expose honey, sugar syrup, or anything that the bees can rob. See that the honey-house is bee-proof, and that all combs and vessels containing honey are removed to a place of safety. Contract all hive entrances, and especially guard against leaving hives open in a way that they can be attacked by robbers. All operations must be carried out quickly. If robbing has started it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the entrance and pile wet grass in front of the hive. This will usually cure mild cases of robbing, but where a colony has been overpowered by the robbers it should be closed altogether.

Care of Extracting-combs.

If proper care is not to be exercised in storing the extracting-combs when removed to the honey-house, it is far better that they should be stored in the hives. If the latter plan is adopted the mats must be placed on top of the brood-chamber, and the supers tiered above the mats. Unless the apiary is well sheltered, however, the hives must be weighted, as the winter gales will easily overset them when only empty combs are stored inside. It is far better to remove the combs if it can possibly be done, and thereby obviate the labour of lifting the supers if it becomes necessary to examine the brood-chamber. But in this case the combs must be properly housed to secure them from destruction by mice and wax moths. It is not uncommon to find tiers of extracting-combs destroyed as the result of carelessness. Mice are especially destructive, and the damage they will do in a short period is such as to render the greatest trouble worth while in preventing them from gaining access to the combs. The price of foundation now ruling is making it far more costly to produce combs, and if large numbers have to be annually produced the renewals become a severe tax on the season's profits.

During extracting many combs may become damaged, but the damage can be repaired by the bees when the combs are returned to the hives. As a rule, however, mice destroy the combs beyond repair, and no effort on the part of the bees can restore them to their original form. It is during the working-season that the beekeeper realizes the value of combs

in securing a crop. A shortage of combs during the flow will often prevent the bees being kept in working-trim, and the production of honey will be greatly restricted. Mice destroy the combs to gain access to the pollen, and render them foul and offensive to the bees.

In the absence of a mouse-proof room the combs can be stacked in supers tiered one above another. Be sure that there are no holes or cracks in the supers through which the mice can obtain an entrance. Place a queen-excluder at the bottom of the tier and another on the top. Queen-excluders, if used as described, are a complete success in preventing mice from destroying the combs during the off-season. Should the wax moth be detected the combs must be fumigated. Bisulphide of carbon is generally used for destroying insect-life, but it should be used with great caution, as it is highly inflammable. It is far better when storing the combs at the end of the season, to place a few moth-balls among them. This will be sufficient to prevent the attack of the moths.

Care of Equipment.

As soon as the honey has been disposed of, all utensils used in handling the crop should be thoroughly cleaned. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c. Wash carefully with boiling water, and dry thoroughly to prevent rusting. The high cost of equipment should impel the beekeeper to take great care in storing his plant during the off-season. It is advantageous to use loose washing-covers of close texture to cover the tanks and extractor. The covers will help to keep the utensils free from dust that is likely to accumulate during the winter. See that all metal parts likely to rust are given a good coating of oil. In season or out of season the watchword of the beekeeper in the extracting-house should be cleanliness.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

EFFECTIVE methods of carrying out cultural operations under various conditions of soil and climate vary widely, and the conditions must therefore constantly receive the most careful consideration to obtain the best results; otherwise opportunities offered by these conditions are missed or the difficulties they impose cause loss if they are overlooked. Even experienced growers are frequently found making serious mistakes when cropping in new localities. Cultural notes offering suggestions to those engaged over the wide range of latitude covered by these islands cannot possibly take into consideration all of these differences, and each grower must depend to a great extent on his own observations for working out the important details upon which a high standard of achievement depends.

Digging and Storage of Potatoes.—The late potato crop is frequently allowed to lie in the ground for some time after it has matured, while other work is being done. If the crop is sound and the climate cold little damage may be done; but in warmer districts, and especially if it is also humid, disease and second growth will probably levy a serious toll. In such cases the crop should be lifted promptly, during the first spell of fine weather, as soon as it matures. If blight is present, bag up the larger sizes for immediate use, keeping a sharp lookout to reject infected tubers. The smaller sizes may be used for pig and poultry feed; do not allow them to remain in the ground. It is usually unwise to attempt to store such produce for a period of any length, as the labour of picking

over and loss incurred is generally very considerable. In such instances, and if at all practicable, the shaws should be burnt. Where the crop is reasonably sound, it should be lifted in fine weather and allowed to lie for a few hours to dry off; then gather the larger sizes and unbroken tubers for storing; the smaller tubers, about 2 oz. in weight, for seed; the remainder should be carefully cleaned up and set aside for feeding stock. No tubers should be left on the surface overnight; all should be bagged up and carted away by the end of the day.

Where only a few bags of table potatoes are concerned, they may be kept satisfactorily in a cool dark shed for some months, if they are quite sound; otherwise they should be marketed without delay. Large quantities of sound potatoes are best stored in a pit or clamp; the site for this purpose should be cool and dry. The vicinity of a pine or cypress plantation frequently provides excellent conditions. A shallow trench about 6 in. deep, 5 ft. wide and as long as necessary should be dug, placing the soil in equal quantities along each side. The tubers are then tipped into the trench and piled as high as possible; they should then be covered with clean straw, or in its absence with rushes, raupo, or dry fern, to a depth of about 6 in. when compressed. This is then covered with about 3 in. of soil to within a foot of the top, and a few weeks later, when transpiration of moisture is less active, the soil covering should be completed and increased to a depth of about 6 in. In moist or warm localities, where there is a danger of heating, vents may be made along the ridge at intervals of 5 ft. or 6 ft. by pulling some of the straw through the soil. If the tubers are sound and carefully handled there should be very little loss.

Small quantities of seed potatoes are best placed in shallow wooden boxes. If these have handles which enable them to be stood one on top of the other without resting directly on the tubers, it is very convenient, as a large number then occupy but little room. A cool airy shed is quite suitable for this purpose so long as it is not too dry; and light, which is detrimental to table potatoes, is in this case an advantage. Large quantities of seed potatoes are often kept in sacks, more especially in the cooler localities, but they should not be piled and the sacks should be turned over occasionally. In warmer districts they are sometimes stored in fruit-boxes stacked in a cool sheltered place in such a way that they do not heat through being too compact or shrivel through being exposed to too much dry air.

However, seed potatoes should only be saved if the crop has been quite saitsfactory. That is chiefly that it is practically of one variety, free from disease, and a good cropping strain. Unless this is the case steps should be taken to obtain "certified seed" of a variety suitable to the locality; do not put it off, take delivery of the seed as soon as possible so that good storage conditions may be assured.

Harvesting Onions.—In some respects the position is the same when harvesting the onion crop. In cold dry districts the crop matures and ripens readily; but in warm localities prompt action is necessary to lift it immediately it matures, or a second growth takes place. The ripening bulbs should be placed under cover in wet weather, or they will soon discolour and lose appearance. When cured and trimmed moderate quantities may be "roped"—that is, the larger sizes; the smaller grade if pickled in a good vinegar will be most useful.

To make a rope of onions take a double piece of cord or flax, knot it at each end, and hang it on a strong nail. Take a bulb in the left hand and with the right take a turn round the double cord with the tough dry foliage, bringing the end over and then under the butt and finishing by taking it between the cords. Slide the bulb down firmly on the lower knot in the cord, and proceed with others in the same way.

Other ways are to store them in bins, boxes, or bags; but whatever the method the place must be abundantly ventilated, dry, and cool. Large quantities must be stacked in an open manner so that heating is prevented by air passing freely through. Such conditions are also suitable for storing pumpkins.

Miscellaneous Work.—The recently sown onion crop for spring planting will require careful management to control weeds. Blanch the celery as required, and in warm localities sow spinach for a spring crop. Plant out cabbage and cauliflower plants for spring cutting.

Breaking in New Ground.

Where new ground is to be broken in for this kind of cropping the matter should receive the most careful consideration. The quality and condition of the soil and subsoil, its situation, and climate, are the main factors which determine the method of bringing it into a fertile state and the crops for which it is naturally suited.

Light land is more quickly broken in than a stiff heavy soil; it is much easier to manage at any time, and is usually warm and "early." But it is very "hungry"—that is, it consumes humus and other manures quickly and so is expensive to maintain in a fertile state. A heavy soil is slowly ameliorated, very retentive, easily spoiled by mismanagement, apt to suffer from lack of drainage, but fertilizers and manures go further. An ideal soil for general purposes is a deep, well-drained loam, but most types of soil and climate are naturally adapted for a certain range of crops, and this should be carefully ascertained by observation and study of the crops grown from year to year.

Some of the main points of the undertaking are to provide adequate shelter from occasional gales, eradicate bad weeds, and see that drainage is adequate. If these features are in order some planting and sowing may be done in the spring with prospects of a crop. If the soil is of an extreme type of sand, clay or swamp, it will take some time (two or three years) as well as labour to build up a fertile condition, but by careful study and well-timed operations fine work may be achieved.

Good immediate shelter may be obtained for a height of 5 ft. or 6 ft. by weaving manuka scrub in a wire fence, or shelter for special crops may be provided by interplanting strips of maize or oats, as is sometimes done for the tobacco crop. For more permanent shelter from prevailing winds a species of *Cupressus* (cypress) is often selected, macrocarpa and Lawsoniana being specially favoured. From other winds which are not so severe good hedges, with in some instances Lombardy poplar interspersed, fulfill all requirements.

The importance of this shelter is such that it should be planted, trained, and maintained with the greatest care. To let it become overgrown and to cut it back roughly at an unseasonable period, or to allow weeds and rough grass to destroy the base, means the loss of a valuable asset. For this reason the land should be prepared before planting shelter as for any other crops; grass and weeds should be turned under and killed, and the subsoil broken up but not brought to the surface.

This brings us to a consideration of the subject of the cultivation of new areas—that is, bringing the soil into a clean friable state suitable for cropping. On light land the operation is comparatively easy, but where the land is heavy it will be slow work unless one is careful. Grassland is drier than that which is in a cultivated state, so that wet weather is not such a hindrance when the former is being broken up. Where the area is small this may be done very satisfactorily by trenching it with a spade, if the trench is maintained at its full size with straight sides and the bottom well broken up. If the turf is skimmed and placed roots upwards on the bottom of the trench before filling, very few weeds will survive the

experience. Where the land is heavy this work should be done without delay, but thoroughly and not hurriedly. The exposed clods will then have time to oxidize before cropping commences; by giving the air and moisture time to act upon the material they will reduce it to a friable state. This will be assisted by occasional hoeing when weeds appear, and perhaps hoeing in half a pound of slaked lime to the square yard.

If the area is rather big for this method, it can be dealt with by means of horse-drawn implements or tractors. Before this is commenced the ground should be well prepared by grubbing out scrub and removing any obstacles; the hedges should be trimmed hard back, and any rough growth at the base removed. The land may then be neatly skim-ploughed so that the slice lies inverted and flat. After a short time in this position the turf is killed and the ground can be cross ploughed rather deeply to bury it. When at the same operation a second plough is used to break up the bottom of the furrow, a first-rate job should be accomplished if it is done soon, so that plenty of time is given the elements to complete their part of the work. As before stated, this action is quicker in the case of a light soil, and in that case early preparation is not so urgent.

Where the underlying stratum is shingly the subject of drainage presents no difficulties; its place is likely to be taken by the problem of providing a water-supply for dry periods. In the case of a clay subsoil, its retentive nature is very apt to make the question of drainage of great importance. A soil must be moist to be really fertile, but if it should be stagnant long air is excluded, beneficial organisms are destroyed, growth stops, and plants die. It is important that the moisture should slowly percolate. It is for this reason that drains are sometimes necessary. There may be an open drain at the foot of falling ground to draw off the water; or across the top to keep flood water off it; or earthenware drain-pipes of 2 in., 3 in., of 4 in. diameter laid in well-graded trenches at short intervals to lower the water-level in the subsoil and so aerate it and make it fertile. For the purposes of intensive cultivation, which demands a high state of soil fertility, drainage conditions should be of the best kind.

What to Plant.

The answer to this question will depend to some extent on the measure of success that has attended one's efforts to break in the new ground. If at planting-time the ground is still rough it is obviously unsuitable for planting the finer seeds, and one must be content to plant the more vigorous kinds. Or if, in spite of a fine tilth having been obtained, there is a doubt about the successful suppression of such bad weeds as twitch or Canadian thistle, &c., it is a bad policy to plant small fruits, rhubarb, asparagus, or anything else that is perennial and will occupy the ground for more than one season. In such a case it is advisable to plant a crop which is an annual, and so provide further facilities for eradicating the troublesome weeds, before planting crops which are to remain on the ground for three years or more.

If the land is right and the crops are required for use or sale, one naturally answers the question by ascertaining the demand; but in this we must not ignore nature, she has a say in this, and it is only by working in harmony with her that anything constructive or of real value may be accomplished. Whether the land is dry or moist, light or heavy, and the climate mild or severe, there are crops suited to each, and a wise choice will take this into consideration. Whether the crops are required for home use or sale there will probably be some diversity, and unless a well-arranged rotation is operated success is likely to be brief.

—W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: FEBRUARY, 1933.

Dominion Meteorological Office.

THE weather in February was more appropriate to a spring than a late summer month in the prevalence of strong westerly winds. It was generally warm, with an absence of extreme temperatures. Except in low-lying eastern districts the rainfall was very heavy.

Rainfall.—On the whole, the month was a very wet one, many places having had double the normal February total. On the low levels in Hawke's Bay, Marlborough, Canterbury, and eastern Otago, however, the falls were below average. This was especially the case on the Canterbury Plains.

Temperature and Sunshine.—On the average, the temperature was about one degree above normal, but the departures varied considerably. February is usually our sunniest month, but this year such was far from being the case.

Pressure Systems. — The month began with a fairly vigorous depression approaching from the west. Strong northerly winds blew on the 1st in and north of Cook Strait. Heavy rain fell on the west coast of the South Island. On the 3rd, a southerly change gradually extended over the Dominion and the depression appeared to be moving away, when it suddenly deepened and became stationary. Rain became almost general, except in the southern half of the South Island, and from Nelson and Marlborough northwards heavy falls occurred from the 3rd to the 4th. On the early morning of the 4th damage was caused in the Rotorua and Bay of Plenty districts by a severe south-easterly gale. The same influence that led to the stormy developments of the 3rd and 4th resulted in an unusual type of depression forming west of the Auckland Peninsula, which did not move away until the 8th. Heavy rain continued to fall in the North Island during this period, and thunderstorms were very numerous. These began in the far North on the 6th, a number of animals being killed by lightning at Mangapai, and were very severe about Auckland and in the Thames and Waikato districts on the 7th. At some places they were reported again on the 8th. On the same day Central Otago experienced thunderstorms and heavy downpours.

On the 9th a change took place in the type of weather, the first of two severe westerly spells which were experienced during the month setting in on this day. Deep depressions passed on the 10th and 14th. Much heavy rain fell on the west coast of the South Island, especially on the nights of the 10th and 14th. There was thunder in the Greymouth district on the night of the 10th and a south-westerly gale blew on the coast. On the night of the 14th and the morning of the 15th, a series of particularly severe thunderstorms occurred in Westland, western and northern Canterbury, Nelson, Marlborough, and southern Wellington. The amount of damage done to telephone and telegraph services was almost unprecedented. Power lines also suffered considerably. At one place in North Canterbury several horses were killed. The Waimakariri River was in flood, and the west coast rivers were high.

There was an interruption to the westerly weather from the 19th to the 22nd while a depression of cyclonic form developed in the Tasman Sea and crossed the South Island. But on the 23rd the westerlies again took charge and continued until the 26th. Rivers once more became high on the west coast, and on the night of the 24th to the 25th, severe thunderstorms were again experienced.

From the 18th onward conditions were disturbed in the Pacific Islands, and by the 25th a cyclone was moving southward through the Tonga Group. This cyclone led to an interruption of the westerly type of weather, and on the 28th a secondary cyclone developed just north of the Auckland Peninsula. Heavy rain fell on this day in the east coast districts of the North Island and in the far North.

Numbers of thunderstorms occurred on the last two days of the month; on the 27th one did considerable damage in North Auckland. There were few days, indeed, that were entirely free from thunderstorms. Small tornadoes occurred, also, at several places.

RAINFALL FOR FEBRUARY, 1933, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	6·35	14	2·31	3·58
Russell	3·95	10	1·46	2·88
Whangarei	6·21	13	2·20	3·96
Auckland	7·75	19	2·63	3·04
Hamilton	8·32	16	2·03	2·91
Rotorua	7·38	17	1·44	3·70
Kawhia	8·98	18	2·05	2·84
New Plymouth	4·11	21	0·65	3·81
Riversdale, Inglewood	6·86	23	1·62	6·07
Whangamomona	5·19	13	1·01	3·95
Hawera	4·93	17	1·46	2·28
Tairua	11·20	15	2·84	4·36
Tauranga	8·04	17	1·73	3·46
Maraehako Station, Opotiki ..	11·49	15	3·96	4·03
Gisborne	4·08	8	2·13	3·30
Taupo	4·44	17	0·93	2·72
Napier	2·19	9	0·61	2·76
Hastings	1·92	8	0·61	2·08
Taihape	5·92	18	1·74	2·14
Masterton	2·80	13	1·14	2·70
Patea	5·30	13	1·80	2·43
Wanganui	5·78	16	2·47	2·41
Foxton	1·99	11	0·87	2·00
Wellington	3·75	10	1·26	2·67
South Island.				
Westport	8·40	19	2·04	5·35
Greymouth	9·23	20	1·43	6·10
Hokitika	12·68	18	1·94	7·14
Ross	16·89	17	2·66	8·76
Arthur's Pass	23·64	18	5·75	9·91
Okuru	14·70	15	3·05	8·95
Collingwood	7·45	17	1·66	5·11
Nelson	2·78	11	0·75	2·59
Spring Creek	1·92	11	0·72	2·13
Hanmer Springs	3·99	11	1·00	3·19
Highfield, Waiau	2·45	7	0·82	2·60
Gore Bay	..	..	..	2·66
Christchurch	0·14	8	0·04	1·71
Timaru	0·44	6	0·32	1·78
Lambrook Station, Fairlie ..	0·80	6	0·30	1·80
Benmore Station, Clearburn ..	1·95	12	0·47	1·61
Oamaru	1·40	7	0·60	1·74
Queenstown	3·31	14	0·78	1·96
Clyde	2·07	12	0·54	1·06
Dunedin	1·95	12	0·38	2·71
Wendon	4·25	16	0·75	2·12
Gore	4·51	17	0·52	2·65
Invercargill	6·71	19	1·18	3·11
Puysegur Point	9·94	21	2·31	5·82
Half-moon Bay	7·43	18	1·25	4·14

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SODIUM CHLORATE AND LIME FOR BLACKBERRY AND GORSE DESTRUCTION.

J. N., Te Uku, Raglan :—

Would you kindly advise me as to what result would be obtained by distributing a mixture of sodium chlorate and lime (as used in the treatment of ragwort) over land infested with blackberry and young gorse. What proportions of the constituents would be the best ?

The Live-stock Division :—

No material advantage would be gained by using lime with the sodium chlorate on either blackberry or gorse, as lime is used only as a diluent and does not aid the sodium chlorate, except when applied to pasture. In that case it assists growth of grass, and thus two things are done at the same time—the destruction of ragwort and improvement of pasture. Sand or powdered pumice, whichever is the easier to obtain, will do equally as well as diluents on land not requiring lime. We would suggest that before you do anything extensive in regard to the application of sodium chlorate you try out the powdered form on a small area and watch results.

FERTILIZER IMPORTATIONS: DECEMBER QUARTER.

FOLLOWING are particulars of importations of fertilizers into New Zealand for the quarter ended 31st December, 1932 :—

Nitrate of soda : Chile, 740 tons. *Basic slag :* United Kingdon, 25 tons ; Belgium, 400 tons. *Bonedust :* Australia, 625 lb. *Chardust and bone char :* Australia, 10 tons. *Guano :* United Kingdom, 5 tons ; Seychelles Islands, 6,838 tons. *Rock phosphate :* Ocean Island, 15,665 tons ; Nauru Island, 19,120 tons ; Tuamotu Archipelago, 4,688 tons. *Other phosphates :* United Kingdom, 175 tons ; Belgium, 72 tons ; Egypt, 160 tons. *Kainit :* Germany, 35 tons ; Poland, 245 tons. *Muriate of potash :* Germany, 12 tons. *Sulphate of potash :* France, 90 tons ; Germany, 125 tons. *Other potash fertilizers :* France, 375 tons ; Germany, 465 tons. *Sulphate of ammonia :* United Kingdom, 2,105 tons. *Sulphate of iron :* Australia, 5 tons. *Other fertilizers :* United Kingdom, 35 tons.

Correction : Importations of rock phosphate from Nauru Island during the three months ended 30th September, 1932, were 53,780 tons, not 53,320 tons as first published.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1932, to 23rd February, 1933, include the following of agricultural interest :—

No. 68546 : Plough ; G. F. Shave. No. 68488 : Holder for paper fruit-wrappers ; E. H. T. Bensemann. No. 69479 : Ploughshare ; F. E. Piesse. No. 69670 : Fibre production ; The Provincial Flax-growers and Millers Association, Ltd. No. 69695 : Harvesting-machine ; S. D. Hillas and J. W. Kidd. No. 67843 : Hay-sweep attachment for tractor ; J. W. and W. M. Thompson. No. 68361 : Butter-churning apparatus ; C. E. Falkner. No. 68598 : Drenching appliance ; E. P. Longdill and J. H. Fergusson. No. 69031 : Mammitis cure ; J. H. Bishop. No. 69298 : Spraying composition : The Grasselli Chemical Co. No. 69654 : Treating wrappers for preserving frozen carcasses ; H. Denford. No. 65850 : Fillers for storing and transporting eggs ; H. V. Gowen. No. 67041 : Milk or cream cooler ; F. B. Hall. No. 69606 : Fertilizer ; Imperial Chemical Industries, Ltd. No. 69937 : Milking-machine claw ; L. Read.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.